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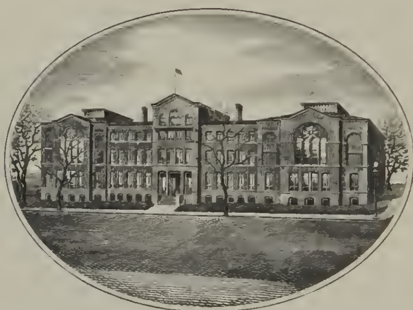

WASHINGTON, D.C.

Dr. B. Gourley.

SURGICAL

AND

PHYSIOLOGICAL WORKS

OF

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SURGEON TO ST. BARTHOLOMEW'S AND CHRIST'S HOSPITALS.

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REFLECTIONS

ON

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ON THE

OPERATION OF PUNCTURING

THE

URINARY BLADDER.

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SIR E. HOME, to whom the profession is much indebted for many important improvements in practice, has of late published some cases of the puncture of the bladder from the rectum, which, in my opinion, are of considerable importance. They not only exhibit that operation as more simple and successful than perhaps was generally believed; but if the operation be as successful in the hands of other surgeons, it presents an easy mode of relief to a great number of unfortunate patients, who have generally been left to die in misery. I mean those who have strictures impassable by bougies, and who are so irritable that they cannot bear the application of caustic, on account of the retention of urine which it occasions. In such cases the puncture from the rectum appears most eligible, because the bladder is contracted, is in general irritable, and will not perhaps ascend high enough to admit of being punctured above the pubes.

But there are cases in which the operation by the rectum cannot be performed; and by frequently meeting with these I have been compelled to puncture the bladder

above the os pubis, and the event of the operation has been such as would have led me to prefer it to any other that I had seen practised. The chief cases to which I allude are those of enlarged prostates, where the catheter has been forced into the substance of the gland, and has torn it considerably; consequently that instrument enters so easily into the false passage as to render it almost impossible to make it take the right one. Indeed, in cases of stricture, where false passages have been made, and the prostate has been sound, the perception of the bladder from the rectum has been so indistinct that I have been deterred from puncturing it; and in one case I made a division in the perinæum; and having passed my finger beneath the arch of the os pubis a considerable way, I could obtain no such distinct perception of the bladder as would authorise me to push in a trochar. But I punctured it above the os pubis, and drew off a considerable quantity of urine. I have therefore been led to conclude, that in some distended bladders there is a kind of recession of them from the perinæum; and that when they become distended they ascend proportionally higher into the abdomen.

In the greater number of cases in which I have punctured the bladder above the os pubis, it has been on a sudden call to the hospital, or some poor-house; and I have had little further concern with the patient than what related to the performance of the operation.

Sometimes I have been in doubt if there was much urine in the bladder; and this circumstance has deterred me from puncturing, except in that situation in which I could possess an assurance that I felt the bladder, and could puncture that viscus: and these doubts caused me in some

instances to puncture the bladder with a lancet; and in some cases I have not left any canula in the bladder, in consequence of the escape of the urine preventing me from readily finding the opening which I had made. Several of the patients died, but in every instance the operation relieved their sufferings; and I have never seen any effusion of urine into the cellular substance, or any other bad consequence result from the operation; nor do I think that such events are likely to happen, if it be rightly performed. The death of the patients was fairly to be imputed to the delay of the operation, or the degree of disease which previously existed in the urinary organs. In several patients who recovered, the progress of their amendment was similar to that which took place in the case which I am about to relate. I did not, however, preserve any detailed account of them; for, as I have mentioned, the patients could scarcely be said to be under my care. I have requested the last gentleman with whom I attended a patient under these circumstances, to give me a particular account of his case; and on the accuracy of his narrative I can place perfect reliance. This case I shall relate, in order to have an opportunity of commenting on the mode of puncturing the bladder above the os pubis.

CASE.

A gentleman, between sixty and seventy years of age, had a retention of urine from an enlarged prostate gland, which obliged his surgeon to draw off the urine night and morning. This was done during ten days, when the difficulty of introducing the catheter, which had gradually

increased, became insurmountable. I was therefore obliged to puncture the bladder; and the only place in which this operation could in the present instance be performed, was above the pubes. I therefore made an incision about two inches in length through the integuments, and between the musculi pyramidales abdominis, so that the lower part of the wound laid bare the top of the symphisis pubis. On introducing my finger into this vacancy I felt the distended bladder. The sensation produced by pressing against the distended bladder is, I think, so peculiar, and so different from any thing else which could occur in this situation, that if an operator has once felt it, he will not hesitate in deciding that it is the bladder against which he presses. The thickness and tension of its coats, and its fluid contents, are the chief circumstances from which this peculiar feel seems to arise. When I first began to perform this operation, I was deterred from using a trochar by a fear of being misled by my sensations. I cautiously punctured the bladder with a lancet, designing to introduce a catheter through the wound; but the urine gushed out so violently, and the bladder became contracted so suddenly, that I could not discover the wound which I had made: yet under these circumstances the urine passed from the aperture in the bladder through the external wound, and was not diffused into the cellular substance. Indeed, neither observation nor reasoning would induce me to suppose that such an occurrence is probable, whilst there is a free external opening. The apprehension seems to have arisen from the extensive diffusion of urine, in cases where the urethra has given way. But in such cases the urine is actually injected into the cellular substance, and with great force by the bladder, in consequence of the channel out of

the body being closed up. If the external wound in this operation were to be closed, and the exit of urine prevented by this means, then it is probable that the urine would be forced to pervade the cellular substance. It may be asked, if urine is in any way likely, according to the common phrase, to insinuate itself into the surrounding cellular substance? I should think not. The operator should be cautious not to make any separation of the bladder from the back part of the symphisis pubis, that there should not be even a cavity into which the urine might gravitate. He should also leave the external wound free and open. The first effect of the operation will be an inflammation, which will consolidate the surrounding cellular substance, and prevent the ready impulsion of urine into it. The stimulating qualities of the urine will augment this inflammation, and thereby increase the effect. Indeed, the stimulus of the urine often occasions a sloughing of the surface of the wound, which, however, makes no alteration in the general circumstances of the case. In later operations I acquired more confidence, and a belief that I could distinguish the bladder from any thing else by its feel; and one case which occurred tended further to embolden me in the performance of it. Being called on a sudden to relieve a patient, who had had his urethra lacerated, and being urged to puncture the bladder by several gentlemen who were present, and who were certain that a considerable quantity of urine was detained. Though I could not feel the bladder distended above the pubes, I consented, as the patient was in imminent danger, to perform the operation; and, having punctured the bladder with a trochar, four or five ounces only of urine were discharged. However, a large quantity of urine gradually flowed through a canula which was introduced. The patient died, and was exam-

ined, when the cause of this occurrence became apparent. A large cyst, made by the protrusion of the internal coat of the bladder, had been formed between the bladder and the rectum, which contained the greatest quantity of the retained urine. The orifice, by which this cyst communicated with the bladder, did not exceed in dimensions the barrel of a common quill. It also appeared that, though the bladder itself could not in this case be said to have been distended, yet the front of it only was wounded by the trochar, and the back part was uninjured.

To return from this digression to the operation in the case which I was relating: after I had, by an incision between the pyramidales muscles, enabled myself to pass my finger along the upper part of the symphisis pubis, so as to press against the distended bladder, I introduced a common trochar of the middle size, in a direction obliquely downward, towards the os coccygis. There is an advantage, as Sabatier, in his Medicine Operatoire, observes, in introducing an instrument in this direction, for it accords with the axis of the bladder, and is therefore not likely to injure the opposite side of that organ. When I found that the instrument had penetrated the cavity, I withdrew the stilet within the canula, and then pushed the canula obliquely downwards, so that about two inches of it were introduced into the bladder. On withdrawing the stilet of the trochar, the urine gushed out with great force, but I prevented its escape, by placing the thumb of my left hand against the mouth of the canula, and then introduced through it, in the same oblique direction, a middle-sized hollow elastic catheter, till it met with resistance by touching the bottom of the bladder. After the urine was discharged, the canula of the trochar was withdrawn over the

elastic catheter, which was left in its situation, and the end which came out of the wound was bent downwards towards the pubes, and attached, so as to be kept motionless, to a circular bandage put round the body of the patient. The wound, which was funnel-shaped, being wide externally, and gradually contracting to the bladder, was covered with linen, spread over with spermaceti salve. The urine flowed not only through the catheter, but by the sides of it. A slight inflammation occurred round the wound, such as would doubtless tend to consolidate the surrounding cellular substance. The surface of the wound in this case did not even slough, at least in any evident degree. Four days after the operation the patient got up, and walked about his chamber; and feeling himself comfortable and well, he did not go to bed again till night. At the end of a week some few drops of urine came through the urethra, and the quantity thus discharged daily increased. At this time, as the catheter seemed to be clogged up with mucus, it was withdrawn, and another was introduced with perfect facility. In about three weeks, as the urine came pretty freely through the urethra, the catheter was withdrawn, and the patient voided his urine by the natural channel. In six weeks the external wound was perfectly healed, and the patient was as well as before the retention of urine took place.

Since the publication of the preceding case, I have many times performed the same operation, and without observing any thing contradictory to the statement which I have given. I shall briefly relate the particulars of one of the cases.

CASE.

A gentleman who came from the country was seized with retention of urine; and the medical man to whom he first applied for relief was unable to draw off that fluid. Before I made any attempt, I first introduced a bougie, which, I think, ought in all cases to be done, in order to examine the state of the parts prior to the introduction of more rigid and injurious instruments. It passed into the prostate, but could not be made to proceed further. A small-sized catheter much curved, or bent upwards towards the point, was next introduced, which entering the bladder, the urine was discharged. Upon attempting to withdraw the catheter, I found that I could not do it without employing considerable force, so firmly was it compressed by the neck of the bladder. I examined the prostate per anum, and did not find that gland materially enlarged, so that I conclude the difficulty of introducing and withdrawing the instrument arose from an enlargement of what Mr. Hunter called the valvular part of the prostate, and Sir E. Home describes as its third lobe. Being fully aware of the improbability of my being able to introduce a catheter night and morning to draw off the urine in this case, I employed for that purpose, at my next visit, a flexible varnished catheter, and left it in the bladder. This gave pain to the patient, and did not long remain in the cavity of the bladder; I was therefore under the necessity of attempting to draw off the urine twice a-day with the common catheter. I succeeded in doing this for several days, each time encountering a difficulty in introducing the instrument, which was surmounted by keeping the point of the instrument closely in contact with the upper part of the canal; and I continued to experience considerable difficulty in with-

drawing the instrument after the escape of the urine.— One morning, however, I was unable to accomplish the introduction of the catheter, and felt myself obliged to puncture the distended bladder. The operation was performed as in the preceding case. A month elapsed before the patient voided any urine by the natural channel. The quantity of that fluid which was discharged through the urethra when he wanted to make water, was at first small, and gradually increased in another fortnight to about four ounces. After this evacuation, the plug being removed from the tube inserted at the pubes, six or eight ounces of urine were discharged from it: it therefore appeared that the bladder had but very partially regained its power of expelling the urine. When this operation is performed, we can know, with some degree of accuracy, when the bladder has fully regained its powers; and, consequently, when we ought to remove the tube. The patient was very anxious to return into the country; and I, knowing the great impediment that existed to the expulsion of the urine in his case, dared not to remove the tube; nor has it appeared proper to do it since that time. He has now kept the tube in his bladder, I believe, more than two years. He has lately complained much of the badness of the varnish with which the tubes are covered; and it is greatly to be regretted that, in this country, no one has the art, or takes the trouble, of varnishing these catheters as they are done in France.

Since the above recited cases were printed, I have performed this operation frequently, and under various circumstances. First, in cases of retention of urine, when the bladder was healthy, but no instrument could be introduced by the urethra, on account of obstinate and much contracted strictures. In these cases the bladder was great-

ly distended, and the patients must have died, if it had not been punctured; yet being healthy, the uninjurious nature of the operation, and its advantages, were strikingly manifested. One patient in the hospital wore the tube in his bladder for nearly four months, which time had elapsed before we had succeeded in so enlarging his strictures as to be able to introduce a moderate-sized bougie into his bladder by the natural channel. The tube was then withdrawn, and the wound through which it passed healed readily and firmly. This patient walked about, without inconvenience, whilst the tube remained in, and rarely had occasion to discharge his urine oftener than three times in twenty-four hours, when nearly a pint of clear urine, without any mucus, was voided through the tube. Secondly, in cases in which the urethra was rendered almost impervious by strictures; yet in which the bladder, was also highly irritable, and would not bear distention. In one poor man in the hospital, whose case appeared hopeless, I resolved to puncture the bladder, though I could not at all distinguish it above the os pubis, merely to mitigate his sufferings. Putting my finger on the symphisis pubis and pushing obliquely downwards, in a direction towards the os coccygis, I felt and punctured the bladder, and discharged about six ounces of the most fœtid urine, mixed with much pus. The patient got well, and left the hospital wearing a tube in his bladder, and in what he considered a very comfortable state, when compared with his former one. No persuasions could induce this patient to permit any attempts to be made to resto e the natural passage. He was convinced of its impossibility from the extreme irritability of his system. He said, also, t at he was sure he had some fatal disease in his abdominal viscera. After he had left the hospital, he applied again for relief, on ac-

count of jaundice. From the time of the operation he had been subject to fits of irritation, attended with the discharge of foul and fœtid urine, mixed with pus. These became more frequent, and, at the expiration of a year and a half, it was ascertained that there was a stone in the bladder. The knowledge of this fact, in addition to his increasing suffering, so wrought upon the patient's mind, that he destroyed himself. In other cases of irritable bladder, however, in which the operation of puncturing was performed, as the only means of prolonging life and mitigating suffering, though the patients lived many years, occasionally voiding very foul urine, mixed with mucus and matter, no calculous concretion was found upon examination after death. The patients whose cases I now allude to were occasionally comfortable, and able to go abroad; but, at other times, their sufferings confined them to their houses, and to their beds. In short, they suffered as persons do with irritable and diseased bladders; but in a less degree, because they could, at will, discharge the contents. Some of these patients had the tubes encrusted with calculous matter, which rendered it necessary daily to remove and clean them. In cases of irritable bladder, combined with a nearly impervious state of the urethra, in which the sufferings of patients demanded the puncture of the bladder, as the only means by which they could be mitigated, or their lives prolonged, I have been unable to puncture it by a trochar, on account of its want of distention. I have, therefore, been obliged to perform this operation with a pointed two-edged knife, and to keep my fore-finger on the aperture, to prevent the escape of the urine, till I was able to insert the varnished tube. I was once obliged to perform the operation in this manner in a case of great obesity; yet all the experience I have

had has tended to convince me, that the puncture above the os pubis is an innoxious and ready mode of discharging the urine, when it cannot be discharged by the natural passages.

ON THE TIC DOULOUREUX.

ON THE TIC DOULOUREUX.

As the public attention has been of late excited to that painful affection of the nerves called Tic Douloureux, I shall, in the next place, relate a case of that disease which lately came under my care; because it seems to me to elucidate the nature of the disorder, to demonstrate the degree and kind of advantage which is likely to result from the division of the trunk of the nerve, and also to illustrate some circumstances in the anatomy and physiology of the nervous system, of which I have not as yet met with any satisfactory explanation.

CASE.

A lady became gradually affected with a painful state of the integuments under and adjoining to the inner edge of the nail of the ring-finger of the left hand. No injury to the part was remembered which could have brought on this disease. The pain occurred at irregular intervals, and was extremely severe during the time of its continuance, which was for a day or two, when it usually abated. Accidental slight injuries always occasioned great pain, and frequently brought on those paroxysms, which, however, occasionally occurred spontaneously, or without any evident exciting cause. In all these particulars the disease correctly resembled the tic douloureux of the nerves of the face. As the pain increased the disorder seemed to extend up the nerves of the arm. After the patient had endured this painful affection for seven years, she submitted to have

the skin, which was the original seat of the disorder burned with caustic. This application gave her intense pain, and on the healing of the wound she found her sufferings rather augmented than diminished by this experiment. After four more years of suffering she consulted me, when the circumstances of the case were such as to render an operation indispensably necessary. The pain of the part was intolerable, and it extended all up the nerves of the arm; and this general pain was so constant during the night, as to deprive the patient of rest. The muscles of the back of the neck were occasionally affected with spasms. The integuments of the affected arm were much hotter than those of the opposite side; and sometimes the temperature was so increased as to cause a burning sensation in them. Under these circumstances, I did not hesitate to divide the nerve of the finger from which all this disorder seemed to originate. I laid it bare by a longitudinal incision, of about three quarters of an inch in length, from the second joint of the finger, and divided it opposite to that joint, by a curved sharp-pointed bistoury which was conveyed under it. I then took hold of the nerve with a pair of forceps, and, reflecting it downwards, I removed a portion of it, half an inch in length, that the possibility of a quick re-union might be prevented. The wound was brought together by sticking-plaster, and it united by adhesion: but the upper part of the wound, opposite to the the upper end of the nerve, became slightly inflamed, and was very painful; however, the appearance of inflammation gradually went off in the course of three weeks. After the operation, I pinched the originally affected integuments sharply with my nails, without causing any sensation; but if in so doing I moved the finger, then pain was felt. I found it difficult to convince the patient

that the skin at that part was actually devoid of sensation, for she still continued to feel similar sensations to those which formerly occurred, though in a much diminished degree: but she became gradually as perfectly convinced as any medical man could be, that these sensations arose from the irritated state of the end of the nerve, above the place where it was divided. The painful affection of the nerves of the arm still continued, though considerably lessened in violence; however, it was sufficiently severe to make the patient apprehend that little permanent benefit would arise from the operation. This pain continued occasionally about four months, with varying degrees of severity, but the temperature of the skin was not hotter than that of the opposite side, as it had been before the operation. At the expiration of three months, the patient ascertained that the integuments at the end of the finger actually felt when any thing was applied to them; and this proved a new source of alarm. More than nine months have now elapsed since the performance of the operation, and the general pains in the nerves have become very trivial; but the sensation of the integuments at the end of the finger has, during that time, gradually increased, and the skin has now its natural sensibility, so as accurately to distinguish the tangible properties of any body applied to it. If also the originally affected part be compressed slightly, painful sensations, resembling those which formerly occurred, take place.

The observations of Dr. Darwin relative to ocular Spectra, and the experiments of Sir E. Home on the contraction of divided nerves, (contained in the Croonian lecture, inserted in the Philosophical Transactions for the year 1801,) have given a kind of demonstration that there is a

subtile and mobile matter superadded to the visible fabric of nerves, and sanction the use of the yet novel terms of the irritability and irritable actions of nerves; and I shall therefore employ them in the few subsequent remarks which I have to offer.

The case above related appeared to me to merit publication; because I believe it is not a common occurrence for the tic douloureux to happen any where but in the face. In the instances related by Sir E. Home in his Croonian lecture, the disease was the effect of an injury done to the thumb; and it is reasonable to suppose that it would not have taken place without a predisposition to it in the constitution of the patients. It is also not unfair to conclude that the disease thus occasioned was of a more general nature, and less confined to the extreme branches of the nerves, and therefore less susceptible of cure by an operation. The case which I have related shows, as indeed might have been concluded *a priori*, that though the source of the irritable state of the nerves in the tic douloureux may be cut off by an operation, yet that the general irritable actions of those organs, which had been excited, and had continued for a long time, would not immediately cease, though they might, as happened in this instance, gradually subside.

The speedy return of sensation, which is both accurate and acute in the present case, must surely be deemed a curious circumstance. It cannot be attributed to a reunion of the divided nerve, since so large a portion of it was removed; for I believe in simple divisions of the nerves by accident, sensation is slow in returning. It must, I think, be admitted, that sensation in the present instance

took place through the medium of the communicating branches of those organs, and probably its speedy renovation was the effect of their unusually active or irritable state.

Nerves strikingly resemble arteries in their modes of communication: sometimes they conjoin even by considerable branches, such as must be manifest in common dissections; but they communicate in surprising numbers by their minute ramifications. This circumstance is not, perhaps, so familiarly known to professional men, since it cannot be perceived, unless in the course of a very minute dissection; and to understand how numerous these communications are, the representations given by the German authors, of their delicate and laborious dissections, may be advantageously consulted.*

The communications of nerves seem also not to have excited much attention amongst physiologists; at least I have not met with any probable conjecture concerning their use. I shall therefore take the liberty of mentioning, as briefly as possible, what has occurred to me on that subject.

The opinions of Mr. Hunter respecting a subtile matter inhering in the brain and nerves, and diffused throughout the body, are, I believe, generally admitted, though variously expressed. Now if the brain and nerves be supposed in those animals who possess them to be the chief if not the sole organs for the preparation of this subtile matter,

* See Meckel's Representation of the Nerves of the Face, or Frotscher's of the Cervical Nerves, in Ludwig's Opera Minora, or Walther's Plates.

then it appears as necessary that the nerves should communicate, as that the arteries should do so. For if the continuity of the trunk of either of these organs were destroyed, the parts which its branches supply would perish, were it not for their communication with the minute branches of other adjacent trunks. It is probable that one of the advantages derived from important organs being supplied from plexuses of nerves is, as has been suggested by Soemmerring, that such essential organs should never want that animation and influence which they derive from the nerves, even should casual obstruction take place in some of the trunks leading to such a plexus. But parts less essential to life equally require that such interruption of the nervous energy should be guarded against. Have we not a plexus formed in the axilla, prior to the distribution of nerves, to the upper extremities? Do not the sacral nerves form a plexus, in order to form the ischiadic or posterior crural nerve? and may not the same circumstance be affirmed with respect to the anterior crural and obturator nerves, since they arise from the complicated union of the lumbar nerves with a branch of the first sacral nerve? The reticular communications of the minute nerves may not only serve the purpose which has been suggested, but, as appears from the present case, the actions which take place in the extremities of the nerves may, by them, be propagated to the sensorium, and thus produce sensation. Whether, in the present instance, the original painful actions of the extremities of the nerves may again recur, and be continued throughout the communicating branches to the sensorium, the future progress of the case will determine.

The lady whose case I have related, died about four years after the operation, of disorder of the digestive or-

gans, to which she was habitually subject. Indeed, from what I have since seen of cases of tic douloureux, I am induced to believe that this disorder is as much constitutional as either gout or rheumatism. I have known patients afflicted with it get well, either spontaneously, or in consequence of the administration of medicines which were likely to relieve or counteract nervous irritability.

ON THE REMOVAL OF LOOSE SUBSTANCES FROM THE KNEE-JOINT.

ON THE REMOVAL OF LOOSE SUBSTANCES

FROM THE

KNEE-JOINT.

I SHALL next relate a case in which some of those loose substances that are frequently found in the knee-joint were removed by an operation: because I think the case contains many interesting particulars, and because it will afford me an opportunity of offering a few observations on the necessity and mode of performing such an operation. Mr. Hey has, of late, recommended a bandage to keep these bodies stationary; and has related several instances of its efficacy, and, of course, of its preventing the necessity o underdertaking a serious and uncertain operation. When loose substances exist in the knee-joint, and are lodged on either side of the patella, they produce but little inconvenience; but when they slip under the ligament of the patella, and become interposed between the condyles of the os femoris and the tibia, they impede progression, and cause pain, and so much injury as to bring on inflammation in the joint. If the extensor tendons, the patella and its ligament, can, by Mr. Hey's bandage, be kept steadily pressed against the corresponding parts of the joint, then these bodies must remain stationary on one or other side of the patella, and the patient will be exempted from the inconvenience and injury which their motion in the joint occasions. Under these circumstances the necessity for an operation is obviated; but in the case which I am about to

relate, the bandage was of no avail, for reasons which will appear in the relation. It is not improbable, also, that though these bodies may occasion much irritation at first, yet that the joint becoming accustomed to their stimulus may afterwards be less affected by their presence, which circumstance ought to be adverted to and ascertained, before an operation be undertaken.

CASE.

A man about forty years of age, having fallen from a ladder, and injured his knee, suffered afterwards a good deal from inflammation in the joint. The joint became much better, but never perfectly recovered; and, after a year had elapsed, he slipped in walking, and again injured his knee. From this time he became sensible of the presence of two moveable bodies in the joint, which incommoded him considerably. They frequently, in walking, got between the condyles of the os femoris and the crucial ligaments, giving him great pain at the time, and produced heat and inflammation of the knee afterwards. He bore this inconvenience for several years, till at length, coming to London, he resolved to submit to the operation for their removal, if it were recommended. When I saw him there was a considerable quantity of synovia in the joint, the knee was hotter than that of the opposite limb, and in this state he said it usually was. There was no difficulty in bringing the two loose substances to the inner side of the joint; and it required only to put that part in a depending position, and those bodies descended by their gavity through the fluid, and were easily fixed in the situation to which they had fallen. I could bring them on the inner surface of the internal condyle of the os femoris, which is of con-

siderable extent; and, by placing the points of my finger so as to describe a portion of a circle, I could prevent them from passing again into the cavity of the joint, although the limb might be moved, and the patient press firmly against them with his finger, as if he meant to push them into the joint. Yet when my fingers, which thus confined them, were removed, the slightest touch caused them to disappear, and to glide with velocity into the general cavity of the joint.

This is the situation, and the manner in which I think these bodies can be most conveniently and certainly fixed. The inner surface of the internal condyle of the os femoris presents an extensive and nearly plain surface, which terminates in front and at its upper part by an edge which forms a portion of a circle. If the points of the finger be firmly pressed upon this edge, so as to form a kind of line of circumvallation round these bodies, they cannot pass into the joint in this direction, nor can they recede in any other, on account of the tense state of the internal lateral ligament. Here these substances are near the surface, and may be distinctly felt; and there is nothing to be divided, in order to expose them, but the integuments, fascia, and the capsule of the joint. Mr. Cruikshank says, that Mr. Hunter preferred removing these loose bodies at the upper part of the joint, as there the bag which contains the synovia has less of the nature of a capsule. Mr. Ford, in a case which required the operation, (and which is related in the Medical Observations and Inquiries,) extracted the substance on the outer edge of the patella; and if the substance is large, it may undoubtedly be extracted in this situation. In the case which I am going to relate, it would have been impossible to fix the loose substances in any

other situation than that which I have described; and, in my opinion, that situation must, in most cases, be preferable to any other, for the reasons which I have mentioned.

I did not hesitate to undertake the removal of the bodies in the present case, as they could be so securely fixed: for the patient had tried bandages without any advantage, which, perhaps, was owing to the quantity of fluid in the joint preventing them from acting in the manner mentioned above. His sufferings were very considerable, and the necessary restriction in exercise extremely inconvenient. I thought it right to reduce the inflammation of the joint as much as possible, prior to the operation, and with this view directed the application of leeches, and of linen kept constantly damp with Goulard's wash: some aperient medicine was also given. By these means, in the course of three days, all the fluid was removed from the joint, and it was as cool and free from pain and inflammation as the other knee: but when I endeavoured to get these bodies into the situations in which I had formerly fixed them, I found all my efforts were in vain. There was no fluid for them to descend through; and though one of them could be got into the situation which we wished, we could not, after trying nearly an hour and a half, succeed in getting both of them upon the condyle of the os femoris. I was therefore obliged to let the patient walk about a little, that some more fluid might be effused into the joint; and then I could bring them both into the same situation, and fix them as readily as before.

The operation was done in the following manner. Sir Charles Blicke, who assisted me, pressed the integuments of the knee gently towards the internal condyle, and then

applied his fingers, in the manner I have described, round the circular edge of the bone. I also drew the integuments gently towards the inner ham-string, and divided them longitudinally, immediately over the loose substance, to the extent of an inch and an half. This withdrawing of the integuments from their natural situation was designed to prevent a direct correspondence in the situation of the external wound, and that of the capsule of the joint; for when the integuments were suffered to regain their natural position, the wound in them was nearer to the patella than the wound which was made in the capsule. The fascia which covers the joint being exposed by the division of the integuments, it was divided in a similar direction, and nearly to the same extent. The capsule was now laid bare, and I gently divided it to the extent of half an inch, where it covered one of the hard substances, which suddenly slipped through the opening, and, by pressing gently upon the other, it also came through at the same part. The bodies, which were thus removed, were about three quarters of an inch in length, and half an inch in breadth. They had a highly polished surface, and were hard like cartilage. The fluid contained in the joint was pressed towards the wound, and about two ounces of synovia were discharged. I then drew the wound of the integument gently towards the patella, pressed the two sides together, and closed it accurately with sticking-plaster, enjoining the patient to keep the limb as free from motion as possible.

No inflammation took place in the knee, either on that day or the following; but on the second night after the operation the patient suffered a good deal of pain, and in the morning the joint felt hot, and was distended with fluid, as it had been before the operation. I now removed the

dressings, and found the wound was closed; but I felt very apprehensive lest, the inflammation of the joint continuing, the collection of fluid should also increase, and, by distending the capsule, cause the wound to open. Having already seen in this case the beneficial effects of evaporating washes, which, by diminishing the heat of a part, check its tendency to inflammation, I was desirous of re-applying them. In order to prevent these applications from loosening the sticking-plaster, and causing the exposure of the wound, I made use of an expedient which I have frequently employed, and which, from its utility, I think deserves to be mentioned. After having supported the sides of the wound in their situation, by adhesive plasters, as at first, I put over them a piece of linen, which extended beyond them in every direction. This linen was made to adhere to the surrounding skin, by smearing over the edge with a solution of sealing-wax in alcohol, and afterwards varnishing the linen over with the same solution. The alcohol having evaporated, and the sealing-wax remaining, no liquid could penetrate and detach the sticking-plaster. This is the same varnish with which some parts of electrical machines are coated, and its power of remaining, unaffected by moisture and moderate warmth, is well known.

Folded linen, kept damp with laudanum and water, was now applied, in the proportion of an ounce of the former to a quart of the latter. This wash I prefer, for the purpose above mentioned, to Goulard's wash; for the precipitated powder contained in the latter is apt to fill the interstices of the linen, and prevent its imbibing the wash, so that the requisite evaporation does not go on. These applications quickly diminished the heat of the knee, and the quantity of fluid contained in the joint speedily decreased. The

wound was daily dressed, and in a week was firmly healed; and in a fortnight the patient might be said to be well. He has, since the operation, walked as much as he was accustomed to do, and has not found the least inconvenience.

I have, since the publication of the preceding case, seen one of the same kind, so curious on account of the number of loose bodies contained in the capsule of the knee-joint, that it seems to deserve being mentioned. I do not exaggerate when I say, they must much exceed a hundred in number, and feel like shot of various sizes, distending the capsule on either side of the patella. There is no fluid in the joint, nor do they prevent the patient from taking ordinary exercise.

ON THE TREATMENT OF ONE SPECIES OF THE NÆVI MATERNI.

ON THE TREATMENT OF ONE SPECIES OF THE

NÆVI MATERNI.

I SHALL relate two cases, and say a few words on the treatment of this complaint, which is a congenital deformity, consisting of a cluster of enlarged vessels, filled, and occasionally distended by the influx of blood from numerous surrounding arteries. The deformity to which I allude is so well known, and so frequent an occurrence, as to preclude the necessity of any description. Mr. John Bell has, of late, proposed an ingenious theory of its formation, and has denominated it an aneurysmal enlargement of the vessels, in consequence of their anastomoses. There can be no doubt that the repletion, distention, and consequent enlargement of the dilated vessels depends upon a kind of inflammatory action of the surrounding arteries; for, if that be wanting, the mark ceases to enlarge; and, if present, it increases in size in proportion to the degree of inflammatory action. In many cases these marks having increased to a certain degree, cease to enlarge; they then remain stationary, or gradually diminish, till they almost disappear. This occurrence is not so frequent as to induce surgeons to expect such an event, or to prohibit, in consequence of such expectation, their removal; for, if they continue to enlarge, the operation must be commensurate to their size. The consequences of bursting are alarming and vexatious. It is not, however, my intention to speak of these affections in general, but only to state what, perhaps, may in some instances be done with success, when the removal of the un-

natural structure cannot be accomplished. For this preternatural enlargement of vessels is not always cutaneous: I have seen it occupying the whole substance of the cheek, neither appearing beneath the skin nor the membrane of the mouth: I have met with it in the orbit of the eye, and have found it covering the whole of an extremity, or nearly one half of the trunk of the body. If any means can be pursued, under such circumstances, to check the progress of the complaint, they surely deserve attention. I was lately so fortunate as to succeed in such endeavours in cases, the relation of which is my chief object at present.

CASE.

A child about two months old was brought to St. Bartholomew's Hospital, with this unnatural enlargement of vessels, distributed every where beneath the fore-arm, from the wrist to the elbow. In a short time it had swollen to that degree, that the circumference of the affected fore-arm was twice the size of the other. The vessels were large and contorted; and, to give the reader an idea of their appearance, I may mention that the child's mother affirmed that they resembled the entrails of a pig, with which she had either been frightened or disgusted during her pregnancy. The skin was of a dusky hue, and had not its natural smoothness of surface. The heat of this fore-arm was much greater than that of the corresponding sound one. Pressure forced the blood out of the vessels, and for the time diminished the bulk of the limb, and made it of a paler colour. The child's mother lives at Turnham Green, where Mr. Graham, an ingenious surgeon, who was for a long time a student at St. Bartholomew's Hospital, also resides. I requested this gentleman to take charge

of the case, and try the effect of the following plan of treatment, which it seemed to me right in institute. First, I was desirous of ascertaining whether a permanent and equal pressure would not prevent the distention and consequent enlargement of the turgid vessels: secondly, whether reducing the temperature of the limb would not diminish the inflammatory action, upon which their repletion seemed to depend. These two intentions admitted of being readily accomplished. A many-tailed bandage of sticking-plaster seemed adequate to effect the first, and wetting the limb with water the latter. These measures were judiciously carried into effect by Mr. Graham; the pressure was first made slightly, and afterwards more forcibly, as the part seemed to bear it without inconvenience. A roller was applied over the plaster, and kept wet, if the limb felt hotter than natural, so as to regulate its temperature. The success of these measures exceeded our most sanguine expectations. The size of the limb gradually diminished, and its temperature became natural. After six months, Mr. Graham removed the bandages, which it was not necessary to continue any longer. The limb was in some degree wasted, from pressure and disuse; but it soon gradually re-acquired its natural size. After the bandages had been left off for a month, I saw the child. The skin was pale, and had a slightly shrivelled appearance. The contorted vessels felt like solid chords interposed between it and the fascia of the fore-arm.

CASE.

A child had this unnatural state of the vessels in the orbit of the eye. They gradually increased in magnitude, and extended themselves into the upper eye-lid, so as to

keep it permanently closed. The clustered vessels also projected out of the orbit, at the upper part, and made the integuments protrude, forming a tumour as large as a walnut. Of course, the removal of this disease did not appear practicable. I was consulted on this case by Mr. Hurlock to whom I related the success of the former experiment. Pressure to any extent was here evidently impossible; but the abstraction of heat, and consequent diminution of inflammatory action, might be attempted. I recommended that folded linen, wet with rose-water, saturated with alum, should be bound on to the projected part, and kept constantly damp. Under this treatment the disorder as regularly receded as it had before increased. After about three months it had gradually sunk within the orbit, and the child could open its eye. Shortly afterwards all medical treatment was discontinued, and no appearance of this unnatural structure remains.

A third case of a very extensive mark of this description, covering the back and shoulder, got well, as I am informed, by the same treatment. I have not, however, been able to learn the particulars. It appears to me probable, from the foregoing cases, that if the preternatural distention of the vessels could be prevented, the blood would coagulate in them; and thus this unnatural contexture of vessels being rendered impervious, might become obliterated.

Many years have elapsed since the publication of these cases; and I have seen numerous instances of such affections, which have ceased to grow, and afterwards shrunk, and been no longer objects of any consequence, when treated in the manner that I have described. I have, therefore, very rarely been called upon to perform operations for the removal of these diseases.

ON HÆMORRHOIDAL DISEASES.

ON HÆMORRHOIDAL DISEASES.

Mr. Hey, of Leeds, in his highly valuable Observations, describes his mode of treatment of the procidentia ani; and that chapter of his work appears to me to deserve particular praise, because I have not found the same treatment recommended by other writers; and because, from the accounts of the patients themselves, it has relieved them from very great inconvenience and suffering. Wishing to corroborate the statement there given, and to add my mite of observation on the practice that is best adapted for the relief of such diseases, I may mention, in the first place, that my attention to this subject was particularly excited, even during my apprenticeship to surgery, from witnessing the sufferings of those who underwent what I may call the natural cure of piles. When these organised bodies are large and numerous, they impede the expulsion of the fæces; and the straining consequent to this impediment everts the bowel. When, at length, the patient is unable to restore the parts to their natural situation, the piles mortify and drop off, and then the bowel retires, leaving the patient considerably relieved from the difficulty and pain attendant on the expulsion of the fæces. The editor of Mr. Pott's work says, that Mr. Pott was remarkably successful in removing hæmorrhoidal excrescences by ligature.* In some cases such means may, doubtless, be proper; yet it

* See Sir James Earl's edition of Mr. Pott's Works, vol. iii.

has appeared to me, that tying hæmorrhoidal excrescences is productive of all that temporary distress which is observable in what I have termed their natural cure; and as there is a general disorder in the functions of the alimentary canal in all such cases, the irritation occasioned by the ligature aggravates this habitual disorder, and produces sometimes very alarming symptoms.

With these facts before me, I was led to examine the structure of those piles which had been removed by a ligature, or which I accidentally met with in the dead subject; and I found them to be merely fleshy substances, possessing no vessels of considerable size, nor such as should deter us from cutting the excrescences away. It is now twenty years since I first began to remove them freely with the knife or scissars; and I have never met with any circumstance to deter me, whilst the relief of suffering which the operation has afforded to some, and the scarcely to be expected and complete cure which it has effected in many, has been highly gratifying. Piles have been supposed to be owing to a dilatation of the hæmorrhoidal veins; and that these veins are sometimes enlarged, is evident from anatomical examination, and from cases which occasionally occur in practice. In a recent attack of an hæmorrhoidal affection, something occasionally protrudes from the anus, which, when punctured, emits a continued stream of blood, as a vein does when opened. When the blood ceases to flow, the protruding part should be replaced, and maintained in its natural situation.

The origin and formation of internal piles is, I think, similar to those which are external. When, from irritation about the rectum, an external pile forms, a swelling sud-

denly occurs beneath the thin skin, near the verge of the anus, and the part is heated and painful. If the skin be divided, the swelling is found to be caused by effused blood; and if the clot be removed, there is no stream of blood emitted as from a vein. If the wound be small, blood again collects beneath the skin, and the swelling is reproduced. If the bowels be regulated, so that the state of irritation, which is the cause of these productions, be mitigated or removed, and if the slightly painful and heated swelling be cooled by evaporating washes, the effused blood is frequently absorbed, and the distended skin appears loose and pendulous. On the contrary, if the irritation continues from there being some permanent disease on the inside of the bowel, then the effused blood becomes an organised substance, and a permanent external pile is formed. The orifice of the anus is often surrounded by tumours of this kind, which, however, do not require to be removed, and are only indicative of internal irritation. In like manner blood is effused beneath the bowel just above the sphincter, and forms an internal pile. If it be divided, coagulated blood may be removed from beneath it, with the same events as occur in external piles. The effused blood is sometimes absorbed, and the pile disappears; but more generally it becomes an organised substance, and increasing in bulk, whilst others also form, they are productive of those inconveniencies that have been represented.

Though the eversion of the bowel may, in many cases, be attributed to the efforts made to overcome the mechanical resistance which these tumours oppose to the expulsion of the fæces, yet the eversion is not, in general, to be solely attributed to this cause. It arises also from an irritable

and striving action of the bowel, which produces a kind of intussusception. Thus, plaits of the bowel often descend in an irritable action of the part during the expulsion of the fæces. I have known many cases of the following description. A person having some disorder of the bowels, and having an urgent call to void the fæces, has suffered afterwards great pain for a number of hours. The next evacuation has been attended with similar consequences; and thus the patients have continued for a considerable time, ignorant of the cause of their sufferings. On introducing the finger, I have distinctly felt, and fairly replaced a fold of the bowel, and the patient has been immediately relieved from all uneasiness; and, by repeating the same act when required, and keeping the bowels regular by a mixture of castor oil and mucilage with cinnamon water, they have suffered no uneasiness subsequent to the alvine discharges, and in a short time this faulty action of the bowel has entirely ceased. But if a patient remains ignorant of the cause of his sufferings, and does not adopt this mode of relieving them, the fold of the bowel becomes irritated and thickened by the pressure of the sphincter muscle; it enlarges and becomes in form adapted to this unnatural situation, and thus we often meet with folds of the bowel forming hæmorrhoidal tumours. When a pile, or any hæmorrhoidal tumour becomes inflamed and swollen, it has a tendency to draw down more of the bowel, and increase the disease.

The eversion of the bowel thus produced from hæmorrhoidal affections, must be considered as a different case from that procidentia, or prolapsus ani, which takes place independently of such affections; and it is to the treatment of the former only that this paper relates.

In the first volume of these observations I have mentioned that, to me, all kinds of irritation inducing local diseases in the lower parts of the bowel, appear to be the effects of a general disorder in the functions of the alimentary canal; and that the correction of the general affection is essential to the cure of the local disease. If the bowels can be got to regularly carry down and discharge the residue of the food once in twenty-four hours, the straining from costiveness, and that irritable and repeated action attendant on purging, both of which must be injurious to the local disease, will cease to aggravate it. The patient should bathe and anoint the protruded parts with ointment, and carefully replace them above the gripe of the sphincter. Under these circumstances hæmorrhoidal tumours, and the procidentia ani often become of so little inconvenience, as not to induce a patient to wish for a more radical relief.

But if, from the magnitude or number of these hæmorrhoidal tumours, such an opposition should be created to the expulsion of the fæces, that the bowel is forced down at every attempt to discharge them; if, from the inflamed and ulcerated state of hæmorrhoidal tumours, they keep up an irritable action of the parts tending to maintain and aggravate the disease, then an operation seems to be required.

I shall now describe, in the briefest manner possible, the treatment and mode of operating which I have found most successful in these diseases. First, it seems essential, prior to undertaking any operation, to get the bowels into the habit of regularly evacuating the refuse matter of the food daily, and the liver regularly secreting a due proportion of healthy bile. Secondly, the bowels ought to be perfectly

cleared before the operation; and this may be accomplished by giving to the patient such a dose of medicine as has been found, by experience, to be likely to answer this purpose, without inducing a continuance of irritation and purging. The bowel being everted to the utmost by the efforts used in evacuating the fæces, and the parts cleansed by bathing with tepid water, the piles should be taken hold of by a double hook, of a breadth corresponding to the length of the pile; and when drawn upwards from the bowel, it may be removed by a pair of scissars. A protruded and thickened plait of the bowel may be seized in the same way; but I think it is better to use the bistoury in removing it, because the depth to which the scissars may cut is uncertain. The incision made by the knife resembles two curved lines, joined at each extremity. The length of the incision should, both for the removal of piles and that of plaits in the bowel, be longitudinal, in the direction of the bowel.

If, therefore, there be a transverse fold of the bowel of considerable extent, I think it best to take away two elliptical portions in the long axis of the rectum, rather than attempt more completely to remove it by a wound made in another direction.

The hæmorrhoidal tumours being removed, the wounds should be suffered to bleed as long as they are disposed to do so, and afterwards the parts should be completely replaced by means of the finger, previously anointed. As irritation is a principal cause of hæmorrhage from the small vessels, and as that is likely to be occasioned by any part of the bowel being lodged within the gripe of the sphincter, and compressed by that muscle, this part of th

operation should be particularly attended to. The patient should now be speedily placed in an horizontal position, the nates should be exposed, and the parts surrounding the anus should be frequently bathed with cold water, to check inflammation and consequent hæmorrhage.

Frequently, from the apprehension of the vexation and trouble of a subsequent hæmorrhage, the surgeon is desirous, after an operation, of tying every vessel that could possibly pour forth blood; yet, after the patient is put to bed, and becomes warm, particularly if there be any circumstance causing local irritation in the wounded parts, hæmorrhage, even to a considerable degree, ensues. The wound is opened and bathed, and often no vessel is discovered bleeding, or requiring a ligature. Diminishing the temperature of parts is one of the most potent means which we possess of lessening inflammatory action; and this seems to be best accomplished by the continual evaporation which is going on when parts are frequently wetted. Formerly I met with much trouble from hæmorrhage, particularly on account of the blood effused into the rectum, creating an uncontroulable propensity to discharge it per anum; and in this act the wounded parts became again protruded and injured. Since, however, I adopted the mode of treatment which I have described, I have witnessed no inconvenience of this kind. In general, the patients feel very comfortable, and the anus seems as if there were no disease. When the parts have been for some time tranquil, and the risk of hæmorrhage has ceased, the parts need no longer to be bathed or exposed.

The patient should be restricted in his diet: the food should be of the most nutritive quality, and such as is likely

to leave the least residue; but the quantity should be as small as possible, because it is an object to keep the restored parts undisturbed for as long a time as possible. If the opening medicine, which has been given with a view to clear the bowels before the operation, should be likely to affect them afterwards, some opium may be administered to prevent it.

Under these circumstances, I have known patients lie for eight or ten days undisturbed; and during that time the wounds, it is probable, had nearly, if not entirely healed, as the subsequent discharges from the bowels were effected without hæmorrhage, or the descent of any part. However, as these patients have a disordered state of the digestive organs, sensations seemingly requiring some alvine discharges for their relief, will induce us to give some opening medicine long before that period. Experience in the case of our patient should have previously taught us, by what dose of medicine we might calculate, with some degree of certainty, to procure one sufficient and lax motion, which should be parted with by the patient with as little effort as possible. It is better that the patient should not attempt to evacuate the contents of his bowels till his sensations become urgent. When a sufficient discharge has taken place, if any thing has descended, it ought to be carefully replaced as it was after the operation. A small dose of laudanum may be given to stop any further effect from the purgative medicine. Now, though such operations, conducted on the plan which I have described, have been productive of the beneficial effects which I have represented in the beginning, it is wrong to promise too much to patients in general, because the irritable and disordered state of the digestive organs, which is habitual, and which

has produced the disease, may keep up a disordered state of rectum afterwards, and occasion new diseases to form of the same nature.

ON FISTULÆ IN THE PERINÆUM.

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ON FISTULÆ IN THE PERINÆUM.

Towards the conclusion of the second part or volume of these observations, when speaking of the effects of diseases of the urethra, I had designed to insert a chapter explanatory of some circumstances relative to those abscesses and diseases which frequently take place, and lay the foundation for fistulæ in perinæo. In consequence of my being much hurried by business at that time, it was omitted; yet, thinking that its publication may be useful, I insert it at the conclusion of the present volume.

It is well known that abscesses form in the vicinity of the urethra, when it is in an irritable state; but there are some circumstances relative to their progress, which, perhaps, have not been generally or sufficiently attended to. When matter forms in the course of the membranous part of the urethra, or in the neighbourhood of the bulb, it does not produce inflammation of the skin, or break like a common abscess; on the contrary, the skin is but little affected, and, as the matter increases in quantity, it appears kept down, as if it were collected beneath a fascia. Under these circumstances it in general comes forwards, in the course of the spongy substance of the urethra, and bulges out in the middle of the scrotum, forming there a tense protuberant swelling. I have sometimes known the matter make its way backwards, and present itself between the thigh and buttock, a little below the rectum. These cir-

cumstances indicate that there is a fascia spread beneath the skin of the perinæum, over the subjacent parts; yet I think the limits of this fascia can scarcely be ascertained by dissection.

The knowledge of its existence appears to me of importance in explaining many occurrences which take place about these parts, though its density and strength varying in different persons, the facts which I am endeavouring to represent will vary in degree in different cases.

The abscesses of which I am speaking are often simple, no urine having escaped from the urethra to give rise to them, though sometimes, after they have been opened, urine is found to pass through the cavity of the abscess, in a greater or less degree.

These abscesses ought, of course, to be treated as collections of matter beneath fasciæ in general; they should be opened at an early period, to prevent their enlargement. A free opening is proper, because the skin being only slightly diseased, and having a great propensity to heal, will sometimes prevent the free escape of any matter or urine which may be in the cavity of the abscess. The cavity will then become distended and enlarged, perhaps in a direction between the rectum and the thigh, requiring another opening to be made in that situation; yet, in general, I have not found it necessary to divide the skin throughout the whole front of the abscess.

The complicated sinuses, which form in some cases of fistulæ in perinæo, do not appear to me to arise from such simple cases, but from the urethra ulcerating in many

parts. Anatomical examination has shown this to be fact in several cases which I have inspected.

The ulceration, or giving way of the urethra, is, I think, generally understood to be the consequence of a stricture, affording so complete an obstacle to the passage of the urine, as to occasion the canal to inflame, ulcerate, or slough above the impediment. It is very evident that this is not unfrequently the case; yet I do not believe that surgeons in general are sufficiently impressed with the knowledge of the following fact, that the urethra may ulcerate in various parts from irritation, even whilst there is a sufficient channel for the free exit of the urine. The following cases are related in proof of this fact:

CASE.

A gentleman had been attended for a typhoid fever for between a fortnight and three weeks. A clyster was ordered for him; but the person who was desired to administer it could not readily introduce the pipe; and, on examination, it was discovered that there was a considerable induration, discolouration, and swelling of one buttock, by the side of the anus. On this account I was desired to see the patient, and the appearance of the part instantly induced me to say that some urine had escaped from its natural channel, and caused the inflammation which had been productive of these peculiar appearances. The powers of the patient's mind were weak and wandering; yet, when I asked him, in a loud voice, whether he had any difficulty in voiding his urine? he replied, "Oh, I told you it was my first grievance." Yet I saw him void his urine freely, and in a moderate-sized stream. Perceiving that there was fluid beneath the thickened and discol-

oured integuments, I divided them, and discharged a considerable quantity of putrid matter, urine, and sloughs. The patient became, for a time, much better, and urine passed freely through the wound; yet he afterwards gradually sunk, and died. In this case the urine must have escaped from its natural channel very high up, and have been forced into the cellular substance connecting the bladder and the rectum, producing that peculiar inflammation which probably occasioned the typhoid fever.

CASE.

A similar occurrence happened to a patient whom I had previously attended, on account of strictures in his urethra, and which had been so far relieved, that a moderate-sized bougie could be passed into the bladder, and he voided his urine freely, in a moderate-sized stream. He had for some months discontinued the use of bougies, previously to the event which I am going to relate. He was seized with a kind of low fever; but his attention seemed to be directed to the seat of his disease, so that it became remarked, at an early period, that the integuments of the buttock by the side of the rectum were inflamed. The similarity of this case to the preceding one induced me to make an incision through the skin and subjacent substance to some depth, when a considerable quantity of fœtid matter and urine gushed out. I saw this patient void his urine, which he did with apparent freedom, and in such a stream as I have described. He was relieved by having an outlet given to the urine and matter, which continued to pass freely through the wound; yet he afterwards gradually sunk, and died. To my great regret I was prevented from examining the parts after death in both these cases.

CASE.

A patient, who had suffered for more than a fortnight with slow fever, in which his intellects were so impaired, that he communicated no information to his medical attendant respecting the nature of his disorder, was observed to have a swelling near his left groin, which was supposed to be a common abscess. This disease increasing, and showing no tendency to break, after a few days I was desired to see the patient. The swelling then was as large as an orange, but oblong, extending from the groin down the front of the scrotum. The colour and induration of the skin, in such cases, are in general so peculiar, as at once to impress the opinion that effused urine has been the cause of the inflammation and abscess. I, without hesitation, cut through the thickened integuments, and discharged about six ounces of putrid pus and urine. A quantity of sloughy cellular substance soon afterwards protruded through the wound, which gradually separated and came away. The patient's intellects soon became clear, all fever left him, and he soon regained his usual state of health. In this case I conclude that the urethra had given way on its left side, in front of the fascia, which covers and binds down the parts beneath the skin of the perinæum, and in the vicinity of the abscess. I mention this opinion to lead us to form a probable conjecture as to the cause of the urine becoming diffused, in some cases, beneath the integuments of the pubes and abdomen.

When circumscribed abscesses form, it is probable that the quantity of urine which escapes from the urethra is small, and that, by its irritation, it occasions adhesion of the surrounding cellular substance. In the case just related, the quantity must have been sufficient to have occa-

sioned the death of a considerable quantity of cellular substance. When the urine is diffused, and injected into the cellular substance extensively, scarifications afford but an ineffectual outlet to it. The practice most appropriate to these cases would be, at as early a period as possible, to make a wound down to the aperture in the urethra, so that whatever urine may escape from the canal should run freely out of the wound, and be no longer forced to pervade the cellular substance. Yet it is difficult, nay, perhaps, in some cases impossible, to know where the urethra has given way; and one object which I had in view in relating these cases was, to induce others to reflect, and to endeavour to ascertain, by experience, how and where we ought, in different cases, to make such wounds as will afford free discharge to the urine, and prevent the horrible effects of its becoming extensively diffused through the cellular substance. Our conjectures respecting the situation of the aperture will be much assisted by the history of the case. If the swelling and inflammation began at the top of the scrotum, near the pubes, it is probable that the diseased aperture of the urethra is in front of the perinæum; if it began on one side, it is probable that the opening of the urethra is on that side. Were Surgeons fully aware of the nature and urgency of the case, and bold enough to do what is required of them; that is, to cut through the swollen and inflamed parts, till they exposed the tube of the urethra, I am convinced many lives might be saved. If the integuments of the perinæum be affected, it is probable that the aperture in the urethra is as far, or farther back than that part: yet respecting this point we may err, it frequently happening that the aperture in the urethra is far back, and yet the integuments of the perinæum may contain no urine, the fascia, which I have spoken of, preventing that fluid from affecting them.

I shall briefly relate two more cases, to exhibit other varieties of these diseases.

CASE.

A gentleman, who was more than seventy years of age, but of a strong constitution, who had never found any difficulty in voiding his urine till a few days before the occurrence which I am about to relate, and who actually did void it freely, in a full stream, after his urethra had given way, so as to allow of the escape of a considerable portion of the urine, was suddenly seized with shivering and severe indisposition. The patient did not complain of any thing being wrong about the scrotum, or urinary organs, till about two days, when he mentioned that his testicles were swollen. When I saw him the scrotum and integuments of the penis were much distended and mortified on the surface, in several large irregular black patches. The distention of the scrotum was not merely occasioned by urine; it was emphysematous also from air extricated by putrefaction. The integuments of the perinæum were scarcely affected. The patient said that the swelling had begun from behind, and on the left side. I concluded that in this case the urethra had given way in the perinæum, and that the urine had passed in the course of that canal, between it and the fascia, which I have spoken of, till it arrived at the loose cellular substance of the scrotum, which it readily pervaded. I know this to have been the fact in some similar cases which I examined after death; and I concluded it to be owing to the resistance of a fascia spread beneath the skin, that the integuments of the perinæum are not affected, even though the urethra has given way beneath them. As the object of surgery is to make an external wound opposite to the orifice in the urethra, I pursued a practice in this case which I had found successful in sev-

eral others of a similar nature, and which I was led to adopt from discovering that the aperture in the urethra was, in some cases which I examined, much farther back than the part where the urine first appeared to have pervaded the cellular substance of the scrotum. I made a wound about two inches and a half in length, through the integuments and subjacent cellular substance of the perinæum and back part of the scrotum, in the direction of the urethra, but more to the left side. The wound need not extend farther back than the bulb, and should, I think, come forwards, so as to divide the integuments of the back part of the scrotum, where the swelling first takes place. The object of this wound is to lay bare the fascia of the perinæum; and the operator may now feel the groove which intervenes between the spongy substance of the urethra and the crus penis. Now, in cases of this description, I have proceeded to divide the fascia, which is spread over these parts, so that I could more distinctly pass my finger into the groove which is formed between them, and gently elevate the fascia from off the spongy substance of the urethra. I did so in the present case, and was anxious that the patient should void his urine, that I might see if it came through the wound which I had made; but he was unable, at that time, to discharge any. However, afterwards when he made water it continued to pass freely through the wound in the perinæum.

Having formerly been perplexed with regard to such cases as I have last described, and having now operated in many similar instances with the same event; that is, with a perfectly free discharge being afforded to the urine which escapes from its natural channel, I thought it might be useful to publish one of them; and thus add another of a different kind, to show the necessity and propriety of our

endeavouring at once to give a free discharge to the urine, by making an external wound, which communicates with the aperture in the urethra.

CASE.

A gentleman of seventy years of age was affected with a kind of intermittent fever, for which he was attended by a physician, from whom he concealed that he had any disease of his urethra. After some weeks, however, the patient informed him one morning, that he had a slight swelling of one testis. On this account I was desired to see the patient, who resided a little way from London. The swelling of the scrotum at that time was not larger than a large apple ; it was situated at the back part of the bag, and on the right side ; and its appearance was very demonstrative of its nature. I urged the patient, but in vain, to permit me to divide the skin ; but he said he would allow no operation to be done, unless in consequence of the opinion of other surgeons in consultation.

I found that he had, for the greater part of his life, been in the frequent habit of passing bougies for himself, and that he was uncertain of his ability to introduce even a very small one. As no consultation could be held on his case till the following day, I called on the patient in the evening, taking with me an extremely small flexible varnished catheter, hoping that I might be able to pass it, or, if I should fail, that I might be allowed to give a free exit to the effused urine. At that time, however, I found the whole scrotum uniformly distended to a very great size, and the integuments of the penis so swollen and projecting, that it was impossible, without an operation, to discover the ori-

fice of the urethra. The patient having appointed other surgeons to attend on the subsequent day, was resolved to abide the result of their opinion, before he would submit to any wound being made. On the ensuing day, several large irregular mortified patches had formed on the integuments of the scrotum and penis; and the patient was so sunk and confused in his intellects, that an operation was, I believe, deemed useless by all present, except myself. I knew the patient was in other respects healthy; and I had many times seen the whole skin slough off from the genitals, and the patients survive and do well. As, however, an operation was the only resource, it was performed. We drew the patient's legs and thighs out of bed, and turning him on his face, the perinæum presented itself in such a manner as to admit of my performing the operation. The integuments of the perinæum were now greatly swollen, which circumstance I had not observed before. I made a wound in the direction of the one made in lithotomy, and cut through between two and three inches of cellular substance œdematous with urine, before I could touch the bulb of the urethra, or other parts situated beneath them. I raised the tumid integuments from off the subjacent parts with my finger, but still no urine flowed. I then endeavoured to pass my finger by the side of the bulb towards the prostate, in the direction of the urethra; and, in a few seconds, about three pints (as I should guess) of highly putrid urine, mixed with purulent matter, was suddenly and forcibly projected. Being now assured that the bladder could readily discharge the urine through the external wound, I cleansed and dressed the parts. The patient got into his bed without assistance, and expressed, with vivacity, all that comfort and relief which every one experiences from the evacuation of a much-distended blad-

der. The mortified patches of skin separated, yet sufficient remained to give a covering to the genitals. Great quantities of mortified cellular substance came through the apertures left by separation of the superficial sloughs. I was able to introduce a very fine elastic catheter, and, by enlarging its size weekly, the urethra regained its natural calibre in all its parts; so that the patient voided his urine in a larger stream, and with more freedom and force than he had done for fifty preceding years. It seems right, however, to add that, after two years, the stream having again diminished, he had recourse to bougies, and met with opposition from the strictures which had contracted again during that interval.

ON

TUMOURS,

AND ON

LUMBAR ABSCESSES.

BY JOHN ABERNETHY, F. R. S.

AN ATTEMPT TO FORM A

CLASSIFICATION OF TUMOURS,

ACCORDING TO THEIR ANATOMICAL STRUCTURE:

THE observations which I have had an opportunity of making in St. Bartholomew's Hospital, on the various tumours which occur in the human body, have been so numerous, that I have almost felt myself under the necessity of forming some classification of those diseases. This classification I have attempted according to their anatomical structure; which allows, at the same time, of a corresponding arrangement of those practical remarks that have been promiscuously collected. I have long felt so sensibly the advantages resulting from an orderly arrangement of this extensive subject, that I have taught it for some years in my Lectures in the manner exhibited in the following pages. I am far, however, from being satisfied with the method which I have adopted; but it is the best that I have been able to devise; and, at least, it has this utility, that it admits of a number of important cases being arranged in a perspicuous manner, and prevents that obscurity which a total want of order necessarily creates.

My motives for laying this paper before the public are; first, a conviction, that an extensive knowledge of this subject, such a knowledge as would lead to an attempt at

classification, and to ascertain the peculiarities which characterise the different species of tumours, can only be obtained by those who have very ample opportunities of observation. But it is probable that, when the subject in general has been surveyed, and its parts pointed out, those parts may be discriminated and examined with accuracy and advantage, by persons who have not had opportunities of contemplating the whole. 2dly, The minds of medical men having of late been laudably excited to investigate the nature of cancer, in hopes of discovering something serviceable in that dreadful disease, it becomes right to remark, and it will appear from the following account, that there are many local tumours and ulcers, as intractable in their nature, and destructive in their progress, as cancer, which are liable to be confounded with that disease, but which ought to be distinguished from it, before any progress can be made in this difficult part of medical science. The society for the investigation of the nature of cancer have enquired about the anatomical structure of that disease, and about other disorders which have a resemblance to it. In the present paper I have attempted to reply to such interrogations, as far as my knowledge enables me. It appears to me, that, in order fully to investigate any subject with advantage, a great deal of collateral knowledge is required, which serves, like light shining from various places, to illuminate the object of our researches. I am not without hopes that this paper will tend to point out the required distinctions, and furnish such collateral knowledge.

In engaging in a new undertaking, I am likely to expose my own deficiencies of information; and by adopting a new and perhaps injudicious arrangement, and employing

new and perhaps unfit terms, I may lay myself open to criticism and censure. I am not unwilling, however, to encounter these risks, when I have it in view to bring a difficult and interesting subject fairly before the public; in hopes that by exciting the attention and engaging the labours of many persons, it may, at length acquire that perfection of which it is susceptible, and which could never be brought about by the exertions of a few individuals.

The subject of tumours occupies a considerable space in the works of the antient writers on medicine. They seem, however, to have considered the subject, rather with regard to its name than its nature; for we find a great variety of dissimilar diseases collected, I cannot say arranged, under the same general title. The error has descended to us, and even in Dr. Cullen's Nosology we find diseases of arteries, veins, glands, tendons, joints, and bones, brought together under one order, and designated by the same name of *tumours*. Some of these also are merely enlargements of natural parts; whilst others are entirely new productions, having no existence in the original composition of the body. We have, I believe, sufficient knowledge of the nature of these diseases to class them more scientifically; and as this has not yet, as far as I know,* been done, I shall endeavour to supply the deficiency.

In the definition which I mean to give of tumours, I shall trespass as much against the usual import of the word, as nosologists have hitherto done in their classifi-

* Plenck published, 1767, a work entitled "Systema Tumorum," which I have not seen, but I conclude that it does not resemble the present attempt; since no arrangement like that which I have made, is to be met with in the Encyclopedie Methodique.

cations against the nature of the disease. For I shall restrict the surgical signification of the word "Tumour" to such swellings as arise from some new production, which made no part of the original composition of the body; and by this means I shall exclude all simple enlargements of bones, joints, glands, &c. Many enlargements of glands are, however, included in the definition, as they are found to be owing to a tumour growing in them, and either condensing the natural structure, or causing the absorption of the original gland. Sometimes also the disease of the gland seems to produce an entire alteration of structure in the part; the natural organization being removed, and a new-formed diseased structure substituted in its stead. In either of these cases the disease of the gland is designed to be included in the definition; and the practical remarks which follow will equally apply to the same kind of diseased structure whether it exist separately by itself, or occupy the situation of an original gland. The structure of tumours is also a part of morbid anatomy which deserves to be examined; since (as it did not come within the scope of the undertaking) it has not been fully discussed by Dr. Baillie in his very valuable treatise on that subject. Yet as he has given representations of glandular parts enlarged by a diseased structure of an entirely new formation; so I shall have the advantage of referring the reader to his accurate and expressive representations of some of those appearances which it is my purpose to describe. There is an observation of this judicious and accurate writer which I shall take the liberty of inserting, since it justly appreciates the degree of utility of investigations like the present: he observes, "that the knowledge of morbid structure does not lead with certainty to the knowledge of morbid actions, although the one is

effect of the other; yet surely it lays the most solid foundation for prosecuting such enquiries with success. In proportion, therefore, as we shall become acquainted with the changes produced in the structure of parts from diseased actions, we shall be more likely to make some progress towards a knowledge of the actions themselves, although it must be very slowly."

The incipient state of tumours will naturally first engage our attention; and those, which perhaps form the best example and illustration of the subject, are such as hang into cavities from the membraneous surfaces which form their boundaries. The cause of tumours having a pendulous attachment attracted the attention of Mr. Hunter, who made the following remarks on the formation of one on the inner surface of the peritoneum, as is related by Mr. Home in the Transactions of a Society for the improvement of Medical and Chirurgical Knowledge, Vol. i. p. 231. "The cavity of the abdomen being opened, there appeared lying upon the peritonèum, a small portion of red blood recently coagulated; this, upon examination, was found connected to the surface upon which it had been deposited by an attachment half an inch long, and this neck had been formed before the coagulum had lost its red colour." Now had vessels shot through this slender neck, and organized the clot of blood, as this would then have become a living part, it might have grown to an indefinite magnitude, and its nature and progress would probably have depended on the organization which it had assumed. I have in my possession a tumour, doubtless formed in the manner Mr. Hunter has described, which hung pendulous from the front of the peritoneum; and in which the organization and consequent actions have been so far completed, that the body of the

tumour has become a lump of fat, whilst the neck is merely of a fibrous and vascular texture. There can be little doubt, but that tumours form every where in the same manner. The coagulable part of the blood being either accidentally effused, or deposited in consequence of disease, becomes afterwards an organized and living part, by the growth of the adjacent vessels and nerves into it. When the deposited substance has its attachment by a single thread, all its vascular supply must proceed through that part; but in other cases the vessels shoot into it irregularly at various parts of its surface. Thus an unorganized concrete becomes a living tumour, which has at first no perceptible peculiarity as to its nature; though it derives a supply of nourishment from the surrounding parts, it seems to live and grow by its own independent powers; and the future structure, which it may acquire, seems to depend on the operation of its own vessels. When the organization of a gland becomes changed into that unnatural structure which is observable in tumours, it may be thought in some degree to contradict those observations: but in this case the substance of the gland is the matrix in which the tumour is formed.

The structure of a tumour is sometimes like that of the parts near which it grows. Those which are pendulous into joints, are of a cartilaginous or osseous fabric; fatty tumours frequently form in the midst of adipose substance. and I have seen some tumours growing from the palate, and having a slender attachment, which in structure resembled the palate. Sometimes, however, they do not resemble in structure the parts from which they grow. The instance just mentioned, of the pendulous portion of fat growing from the peritoneum, will serve as a proof: the

vessels, which had shot into it, made the tumour into fat, whilst the neck was of a fibrous and vascular structure. I have seen osseous tumours unconnected with bone or periosteum; and indeed, in general, the structure of a tumour is unlike that of the part in which it is produced. Therefore we seem warranted in concluding, that in many cases the nature of the tumour depends on its own actions and organization; and that, like the embryon, it merely receives nourishment from the surrounding parts.

If, then, the coagulable part of the blood be from any cause effused, if the adjacent absorbents do not remove it, and the surrounding vessels grow into it, the origin of a tumour may be thus formed. It may be right to reflect a little on the causes which may occasion a deposition and consequent organization of the coagulable part of the blood; as such reflections throw light on the nature and growth of tumours, and lead to the establishment of principles, which are applicable to tumours in general. The deposition of the coagulable part of the blood may be the effect of accident, or of a common inflammatory process, *

* It will probably be useful to illustrate this subject by the recital of a case:—

CASE.

A medical practitioner bruised the upper part of his thigh against the pummel of a saddle, in consequence of his horse starting. The bruise and slight inflammation attendant on this accident soon disappeared, but after some months, he perceived a small tumour, which gradually increased, till it acquired a considerable magnitude. He came to London, and had it removed. It was an adipose tumour, and had a distinct capsule inclosing it, formed by the condensation of the cellular substance in which it had grown.

or it may be the consequence of some diseased action of the surrounding vessels which may influence the organization and growth of the tumours.

In the former cases, the parts surrounding the tumour may be considered simply as the sources from which it derives its nutriment, whilst it grows apparently by its own inherent powers, and its organization depends upon actions begun and existing in itself. If such a tumour be removed, the surrounding parts, being sound, soon heal, and a complete cure ensues. But if a tumour be removed, whose existence depended on the disease of the surrounding parts, which are still left, and this disease be not altered by the stimulus of the operation, no benefit is obtained: these parts again produce a diseased substance, which has generally the appearance of fungus, and, in consequence of being irritated by the injury of the operation, the disease is in general increased by the means which were designed for its cure. It appears, therefore, that in some cases of tumours, the newly-formed part alone requires removal, whilst in others the surrounding substance must be taken away, or a radical cure cannot be effected.

There is yet another circumstance deserving attention, before I proceed to the particular consideration of the subject; which is, that a tumour once formed, seems to be a sufficient cause of its own continuance and increase. The irritation which it causes in the contiguous parts, is likely to keep up that increased action of vessels which is necessary to its supply; and the larger it becomes, the more does it stimulate, and of course contribute to its own increase.

Suppose then a tumour to have formed, and increased; it will continue to grow and to condense the surrounding cellular substance, and thus acquire for itself a kind of capsule. Tumours are more closely or loosely connected to the surrounding parts; which circumstance seems to depend upon the degree of stimulus which they occasion, and the inflammation which they thus excite. This irritation perhaps may be the cause why some tumours, which are slow in their first increase, grow rapidly after they have acquired a certain size.

These preliminary observations will be referred to, when the different kinds of tumours are described. When the history of different kinds of tumours is spoken of, there will be frequent necessity to advert to the effects of medical treatment upon them; it therefore seems right to premise a few words upon that subject.

It can scarcely be doubted that when tumours form and grow, there exists an increased state of action in the adjacent vessels, and the first curative intention in these diseases will therefore be to repress as much as possible this unusual exertion of the vessels, which gives rise to the formation of a tumour, and, by its continuance, causes its increase.

I know of no local measures to diminish an increased or inflammatory action of any part of the body more rational in theory, or more efficacious in practice than those of taking away the two great causes of animal actions, the blood and heat of the disordered part. The former is generally accomplished by means of leeches applied in its vicinity, which should be repeated as circumstances indicate; and

the latter, by the application of folded linen, wetted with sedative lotions, by which a continual evaporation and constant abstraction of heat is kept up from the surface of the skin. The effect of this last mode of treatment is much more considerable than at first sight might be supposed. It operates on parts far beneath the surface. As heat is so transmissible a substance,* so in proportion as the temperature of the skin is diminished by evaporation, it derives heat from the subjacent parts, and thus are their morbid actions lessened.† If by such means the growth of a tumour be suspended, another curative indication naturally arises, which is to promote the absorption of the new formed substance.

This indication is generally attempted by the use of stimulants, such as frictions with mercurial ointment, pressure, and electricity, or by means which also excite some counter-irritation, as rubefacient plasters, solutions of salts, blisters, and issues. Both reason and experience equally demonstrate the impropriety of using the stimulating plan

* Though this expression may not be correct, the idea which is designed to be conveyed by it, will, I believe, be understood.

† The regulation of the temperature of diseased parts, seems to be an important object in the treatment of local diseases; and it is very possible, that by producing evaporation from the surface we may chill them. Patients, therefore, ought to be apprised, that our object in the use of evaporating washes, is merely to prevent an unnatural degree of heat. It is not necessary that the washes should be applied cold to accomplish this object. A chilly sensation imparted to a portion of the skin may affect the whole surface, and produce that affection which we call a cold. In many cases a bread and water poultice seems to me the best application we can employ, both with a view to abstract superfluous heat, and on account of its soothing properties. It is indeed a local warm bath, and, like the bath, it induces a gentle perspiration from the surface.

till the disease is first tranquillized, and in a degree subdued. It is reasonable to expect that stimulating measures will increase the actions which are going on in the diseased part; and experience proves that diseases are often increased by those very means which, had they been employed at a proper time, might have effected their cure. This may be elucidated by a fact which is, I believe, generally known and admitted, that if a blister be applied for the cure of a pleurisy before evacuations are made use of, and the activity of the disease be thus checked, it aggravates the disease; if afterwards, it speedily effects a cure. If a tumour or any local disease be for a time benefitted by stimulating discutients, and the diseased actions recur in it with a degree of activity, it is better to desist from this latter plan of treatment, and adopt again the former one, till the disease is by such means rendered inactive.

I am so well convinced of the necessity of attending to the time and circumstances in which these remedies are applied in order to give them their real efficacy in the cure of local diseases, that I have been induced to dwell longer on this subject than may perhaps to some seem necessary.

When a blister is made permanent, or a seton or issue is made in the vicinity of a disordered part, it is in fact producing a new but curable disease, in order to detract from an old one, over which we have less controul. But here the same observations apply. We should not produce a new disease till the active state of the original one is diminished. and till it is, as it were, rendered dormant; for otherwise the irritation of the intended remedy will rather tend to the aggravation than the cure of the disorder; it will also increase the febrile disturbance of the constitu-

tion, by adding to the causes of irritation. It should also be borne in mind, that the intended remedy is a disease of our own creating; and if it be a painful one, that it may, by disturbing the constitution, do more harm in this way to the original disease than good by its counter-irritation.

Such are the local means of treating tumours, as well as other local diseases, and to these I shall have occasion to refer. I cannot speak of the general means usually employed to operate on these disorders without entering into a long, and, I think, an unnecessary discussion.

In attempting a classification of tumours, I shall suppose that they may be made to constitute an Order in the class of local diseases in nosology; and the meaning of the word may be restricted, in the manner suggested, to substances of new formation, which made no part in the original structure of the body; the order may then be divided into genera; and the first genus may be denominated from its most obvious character, (that of having a firm and fleshy feel,) Sarcoma, or Sarcomatous tumours.

This genus contains many species, to a description of which I next proceed. The first of which I shall treat, being apparently composed of the coagulable part of the blood, rendered very generally vascular by the growth of vessels through it, without having any noticeable peculiarity in their distribution, may therefore be called

Common Vascular, or organized Sarcoma.

The names by which I have distinguished the different species of sarcoma have been objected to, because they

are derived from internal circumstances, and not from any information which can be acquired prior to an operation. I have not, however, been able to devise any better mode of denominating these tumours: for all the species must agree in the external characters, those of an increase of bulk, and a fleshy feel. If, however, an arrangement of tumours were once made, so that the history of each species could be particularly remarked, we might perhaps be able, from this circumstance, to form a probable opinion of the nature of the tumour, and of the mode of treatment which it would require; and, by adverting to the structure of the removed tumour after an operation, we might determine whether it would be right to remove or leave the contiguous parts. It is designed, then, to include under this title all those tumours which appear to be composed of the gelatinous part of the blood, rendered more or less vascular by the growth of vessels through it.

The vessels which pervade this substance are, in different instances, either larger or smaller, more or less numerous: they are distributed in their usual arborescent manner, without any describable peculiarity of arrangement. This kind of tumour seems to be the most simple in its nature; many, perhaps all, of the varieties of tumours, were at first of this nature. The fatty tumour lately mentioned was doubtless at first a common vascular substance; but the vessels secreted fat in the body of the tumour, whilst the neck underwent no such change.

They are such tumours, then, as are organized throughout, but without distinguishable peculiarity of structure, that are meant to be considered under this title. This structure is met with not only in distinct tumours, but like-

wise in the testis, mamma, and absorbent glands. In the testis I have seen the vessels, very numerous and small, dispersed through every part of the tumour. In the mamma they seem to be rather large than numerous, and the organization appears less complete.

When this kind of tumour has attained a considerable size, the superficial veins appear remarkably large; on which account, together with their curiously meandering course beneath the skin, they cannot fail to attract attention. Perhaps the weight of the tumour compresses the deeper seated veins, and obliges the blood to return in larger quantities through those nearer the surface; or perhaps these vessels undergo a kind of sympathetic enlargement; for they do not appear to be distended by the blood which they contain.

These tumours are generally dull in their sensation; enduring even a rough examination by the hand, and electric shocks, without becoming painful. I suspect that it is this kind of sarcoma which sometimes, though rarely, suppurates; but as, when that event takes place, even partially, the rest of the substance is, in general, speedily removed by absorption, I have had no opportunity of ascertaining this circumstance.

These tumours generally grow till the skin is so distended that it ulcerates, and exposes the new-formed substance; which being as it were obliged to inflame, and not being able to sustain disease, sloughs and falls out; sometimes portions seem to be detached, and come away without sloughing. In this manner is the disease occasionally got rid of; but such is the constitutional irritation attend-

ing this process, and the disgusting fœtor and frightful appearance of the part, that the surgeon generally recommends, and the patient submits to its removal at this juncture.

As cases will probably convey more information in less words than description or narrative, and as they identify the kind of disease which is meant to be described, and inform, as it were, by example, I design to relate one or more cases of each kind of tumour, and thus curtail, as much as I can, my description of them.

CASE I.

A woman, between forty and fifty years of age, was admitted into St. Bartholomew's Hospital, on account of a considerable tumour which had grown on the inside of the knee, and had so concealed the tibia, that it could not be felt. She remembered it when of the size of an egg, but could give no information to our inquiries, whether in that state it was fixed to the bone, or moveable upon it. It measured two feet in circumference, and had been gradually increasing between three and four years. The veins were large, and formed an appearance like network on the surface.

As the tumour advanced in size it had gradually prevented her moving about till it entirely confined her to her bed. In this situation it was not painful till within half a year before her admission into the hospital; when, from the sense of distention of the skin, and the inflammation induced in that part, she became restless and feverish, and lost her flesh considerably. At length, the skin ulcerated, and the exposed tumour inflamed and sloughed at different times, so as to leave a cavity in it of the size of a pint-bason

From the sides of this cavity there was poured forth a most copious and fœtid discharge : she had frequently lost blood from the vessels laid open by ulceration or sloughing; and, on her admission into the hospital, she had a confirmed hectical fever through weakness and irritation.

The state of the patient's health, the magnitude of the tumour, the uncertainty of its origin, (for it was supposed to have arisen from a diseased bone,) made amputation appear the only means of preserving life. Upon an examination of the amputated limb, which was previously injected, this tumour was found to have no connection with the bone or joint upon which it lay. The lower part of the tumour was covered by a thin capsule, made apparently of condensed cellular substance, and it was loosely connected to the parts on which it lay; but on the surface of the tumour next the skin the capsule firmly adhered to it, in consequence of the inflammation which had taken place. The substance of which the tumour was composed appeared to have been originally of a coagulable nature, and the vessels which ramified through it appeared to be rather large than numerous; yet this appearance might have arisen from an imperfect injection.

This single case is sufficient to convey all the general information on this subject which I have obtained. It is unnecessary to add parallel instances, and I am unwilling to load the account with minute particulars, lest they should obscure the principal facts. Probably from the want of knowledge I may have included, without discrimination, many varieties in this species of tumour; and, perhaps, further observations will furnish more specific distinctions in these diseases. The subject is but begun; and the difficulty of the investigation will, I hope, apologize for the small advances which I have been as yet able to make.

Adipose Sarcoma.

This is a very common species of sarcomatous tumour, and is formed most commonly on the front, or back part of the trunk of the body, and sometimes in the extremities.

Although it is generally formed in the midst of cellular and adipose substance, there can be little doubt that its origin is like that of other tumours: that, in the first instance, it was coagulable lymph, rendered vascular by the growth of vessels into it, and that its future structure was the consequence of their arrangement and actions. That this was the case in the pendulous tumours mentioned in the preliminary observations seems to be certain.

The distinct origin of such tumours is made sufficiently evident, by observing, that they have always a thin capsule of common cellular substance, which separates them from the contiguous parts. This capsule seems merely to be the effect of that condensation of the surrounding cellular substance, which the pressure of the tumour occasions. As the growth of adipose tumours is regularly and slowly progressive; as nothing like inflammation in general accompanies their increase; their capsules afford a striking instance of an investment acquired simply by a slight condensation of the surrounding cellular structure, unaffected by inflammation. The capsule which is very thin, adheres but slightly to the tumour; and the principal connection appears to be by vessels, which pass through it to enter the substance of the tumour. These vessels are so small, and the connection so slight, that no dissection is required to separate it; for when the tumour is to be removed, the hand of the operator can be easily introduced between it

and its investment, and it is thus readily turned out of its capsule.

The vessels of adipose tumours are neither large nor numerous; they are readily torn when the separation alluded to is attempted, and they scarcely bleed after it has been effected. It is natural to suppose when the greater part of a large tumour has been detached, and no vessel of consequence has been divided, that some principal nutrient artery will afterwards be met with; and this supposition produces an unnecessary hesitation on the part of the operator. There is indeed no species of tumour that can be removed with so much celerity, with such apparent dexterity, or with such complete security against future consequences, as those of an adipose nature. In some instances, however, when inflammation has been induced, the capsules even of these tumours are thickened, and adhere so as not to be separable without difficulty from their surface. To certify this remark, I may mention the case of a man who had an adipose tumour growing beneath the skin of the nates, in which the pressure from sitting occasioned inflammation, and this kind of tenaceous adhesion of the capsule to its surface. This circumstance made the separation of the skin from off its surface difficult, when the extirpation of the tumour was undertaken; but, after that was accomplished, the base of the tumour was lifted up and removed with great facility, and almost without the use of the knife. The under part of this tumour had not a regular surface, but projected in portions so as to have a lobulated appearance; a circumstance which is not unfrequent, and which deserves to be mentioned. From the occurrence of inflammation likewise these tumours sometimes adhere to the contiguous parts; of which circumstance the case which I am about to relate affords a curious example.

I have known several fatty tumours growing at the same time, in different parts of the body of the same person.

I shall take the liberty of giving an account of the extirpation of a very large tumour of this kind; as the case is particularly interesting, and shows that the circumstances usually met with are unaltered by the size of the tumour.

CASE II.

A healthy middle-aged man had a tumour formed apparently beneath the fascia of his thigh, which he remembered when it was no bigger than an egg. It had increased by a regular and slow progress, in little more than four years, to a very great magnitude, such as may be easily supposed, when it is told, that it weighed after removal, between fourteen and fifteen pounds. It had been attended with no pain during its increase, and was now only inconvenient by its bulk.

The surgeons who first saw this patient, would not undertake any operation, feeling an uncertainty as to the nature and connections of the tumour; though they all agreed that, when the skin gave way, there was but little chance of the poor man's surviving the consequences of such an exposure. Considering from the history of the case, that the tumour must have been removable in the first instance; believing, from its freedom from pain and irritation, that it was of no malignant nature, and that an operation was only alarming from its magnitude; I recommended the patient to see the most eminent surgeons in London, before he returned in despair to the country, from whence he had come for relief. Mr. Cline gave

him more direct hopes of success than he received elsewhere, and he went into St. Thomas' Hospital to submit to the operation.

When Mr. Cline had divided the skin and fascia of the thigh, the tumour was easily turned out; but it had unfortunately acquired a ligamen'ous adhesion to the orbicular ligament of the hip, which could not be separated without, in some degree, injuring that part. This attachment appeared to be about half an inch in breadth, and about one fourth of an inch in length. The cause and nature of this firm attachment to the ligament of the hip seems the only circumstance peculiar to this case, or requiring explanation. It appears to me easily accounted for, by supposing the tumour to have compressed and irritated that part, and thus to have occasioned an adhesion, at first of a glutinous nature, but which afterwards becoming organized, had assumed the structure of the parts from whence it proceeded. In like manner tumours growing near and compressing the surface of bones, frequently occasion a degree of exostosis.

No hæmorrhage followed the removal of the tumour. The wound at first appeared disposed to do well; but the patient became feverish, and it did not unite by adhesion. There were also some symptoms indicating inflammation about the hip-joint. The man, however, surmounted these difficulties, and, after some months, was discharged from the hospital.

There were two circumstances in the operation attended with danger; one, the size of the wound, which could hardly be expected to unite by adhesion, on account of the irritation, which, from its extent, must be created; the

other, this unlucky attachment to the ligament of the joint. It is to be lamented, that a disease, so readily removeable in its commencement, should have been suffered to acquire a magnitude, which alone was a source of danger.

Since the publication of the first edition of these observations, I have seen an abscess form in the substance of an adipose tumour. Earthy matter was also deposited on the sides of the cavity which had contained the pus. I have also seen osseous matter deposited within the substance of an adipose tumour.

Pancreatic Sarcoma.

The next species of sarcomatous tumour, which I shall describe, resembles in appearance the pancreas, and, on that account, may be named (if the etymological import of the word be not considered as prohibitory) Pancreatic Sarcoma.

This new-formed substance is made up of irregularly shaped masses: in colour, texture, and size resembling the larger masses which compose the pancreas. They appear also to be connected with each other, like the portions of that gland, by a fibrous substance of a looser texture. This kind of sarcoma, though sometimes formed distinctly in the cellular substance, more frequently occurs in the female breast, perhaps originating in lymphatic glands; and, as cases of this kind sufficiently illustrate its nature and progress, and appear more interesting in proportion to the importance of the parts concerned, I shall select some instances of it, in this part, to show those circumstances which seem most important in the history of this species of sarcoma.

I shall, however, first relate a case of this diseased structure occurring in the lymphatic glands beneath the lower jaw, and afterwards speak of its progress, when it takes place in or near the female breast.

CASE III.

A man came to St. Bartholomew's Hospital from Oxfordshire, with three diseased lymphatic glands, each of the size of a very large plum. They were situated beneath the basis of the jaw, upon the mylohyoideus muscle. They resisted the attempts which had been made to discuss them; and had not been removed, from an apprehension that a dangerous hæmorrhage would take place in the operation. The glands had gradually, though very slowly, attained their present magnitude, for the disease was of fifteen years' duration. The surrounding parts were not affected. Sir Charles Blicke undertook and accomplished the removal of the diseased gland, the structure of which was exactly such as has been described. This case is related in the first place, as it shows most clearly the usual characteristics of this species of diseased structure; which are those of slowly increasing, of not being prone to inflammation, or tending to suppuration.

It may not be improper to mention, though it is irrelevant to the present subject, that, in the operation, the external maxillary artery was unavoidably divided. It did not, however, bleed immediately after the operation, so that this circumstance was not perceived; and the edges of the wound were brought together by one suture, and accurately and firmly closed by sticking-plaster. Shortly afterwards the patient felt a sense of choking, which in-

creased to a state almost of complete suffocation. Indeed it seems probable that this might really have happened before any one could have come to his assistance, had not some of the plasters fortunately given way, and afforded some discharge to the blood: for a very great quantity of coagulated blood had collected within the wound, and compressed the trachea and pharynx to a greater degree than would readily be believed by those who had not witnessed the fact. This circumstance is mentioned to show the impropriety, when there is any chance of hæmorrhage, of closing wounds so strictly by sticking plaster, as to allow no exit to any blood that may be effused; and it is particularly unsafe in circumstances similar to those of the foregoing case. If the hæmorrhage be but small in quantity, and the escape of the blood be prevented, it separates the sides of the wound which should lie in close contact, and thereby prevents their immediate union; and if it be considerable, it deserves to be remarked, that, so far is the compression which the confined blood must make on the arteries, from which it was poured, from stopping the bleeding, that it seems to be a stimulating cause, exciting an hæmorrhagic action in the vessels. This remark is manifested by the present, as well as by many other cases in surgery.

This kind of sarcoma frequently forms amidst the mammary gland, a little above and on that side of the nipple which is next to the arm. Its appearance would lead one to suppose, that it was a lymphatic gland which is usually found in that situation, converted into this structure; but sometimes it seems like a distinct tumour. It is the appearance of the capsule which invests the tumour, that has led me to form these opinions.

These tumours lessen in bulk if judiciously treated; but if they cannot be entirely dispersed, they increase gradually: and when they have attained some considerable size, they are generally removed, from apprehension of the consequences which they might produce, if they were suffered to remain. If the tumour be indolent, and if it increases slowly, the parts surrounding it, and the glands in the axilla are not affected. But some tumours formed by this kind of diseased structure, which do not unfrequently occur in the breast, are, contrary to the ordinary properties of such diseases, of a very irritable nature, occasioning severe and lancinating pain, and producing an inflammatory state of the skin which covers them so that it becomes adherent to their surface. They also irritate the absorbents leading to the axilla, and produce enlargement of their glands. From these circumstances I suspect that these tumours may be frequently considered as cancers. These extremely irritable tumours do not generally attain any considerable magnitude; they are reduced in size by the treatment which has been mentioned, but increase again when it has been desisted from. Sometimes a tumour of this nature, which was irritable in the first instance, becomes indolent after the activity of the disease has been checked by proper local applications, but in other cases the irritability of the disease recurs. The pain is lancinating, and so severe as to make the patients feverish, grow faint frequently, and lose their muscular strength. When the axillary glands become affected, one generally swells at first, and is extremely tender and painful; but afterwards the pain abates, and it remains indurated; another then becomes affected, and runs through the same course. I remember an instance where many of the glands attained a considerable magnitude. The case was consid-

ered as cancerous, and the tumour, which was of the structure that has been described, and also some of the diseased glands, were removed, but several were left and the patient did well.

CASE IV.

A young woman who lived with me as a servant, suffered for more than two years severe pain, and considerable constitutional indisposition, from a tumour of this kind, which had caused inflammation and enlargement of three of the axillary glands. Being assured that it was not carcinomatous from its diminution under surgical treatment, I waited in hopes that some beneficial change would spontaneously take place; but, at last, by her request, and with the coinciding opinion of Sir Charles Blicke, I removed the original tumour, leaving the diseased glands in the axilla. The source of irritation being taken away, the glands gradually subsided, and the patient soon grew fat, and became, and remained remarkably healthy. I have known many similar cases.

When the above account was written, I was unacquainted with those facts recorded in the first volume of these observations, which show that considerable tumours of the breast and neighbouring parts, which resist all locally repellent measures, may be dispersed in many instances readily, by correcting a disordered state of the digestive organs. I have no doubt, but the occasional fits of pain and languor, which were experienced in the case just related, were the effects of irritability of constitution, and might have been relieved, and prevented, by means that would have given tone and tranquillity to the system.

CASE V.

A lady about twenty-seven years of age, had a tumour between the breast and the axilla, which had gradually increased during a year and a half to the size of a goose egg. Its growth had been accompanied with occasional fits of pain. She had a much furred tongue, and costive bowels. As no discutient remedies had checked the progress of the tumour; and, as some apprehensions that its nature might be malignant were entertained, I was requested to remove it.

After I had done so, on dividing the tumour, its structure was found to be of that kind which I have described in this section; which induced me, for the comfort of the patient, to assure her, that the disease was not cancerous, and therefore not likely to return. The patient resided in the country, and when she left town, I exhorted her to be very attentive to her diet, and to the regulation of the functions of their digestive organs. After two years she came from the country much alarmed, by a good deal of thickening irritation, and redness, which had taken place in the parts wounded in the operation; all of which, however, soon subsided. under the application of a bread and water poultice during the night, and the use of alterative doses of mercury. In another year she returned again frightened by the occurrence of a swelling, attended with uneasiness, on the side opposite to that on which the operation had been performed. The swelling was situated between the breast and the axilla, parallel and contiguous to the margin of the pectoral muscle. It was as big as a small walnut; and, I have no doubt, was caused by the tumefaction of an absorbent gland. It was dispersed by the same treatment

that had been instituted for the irritation which had taken place about the wound. About three years have now elapsed, and though she has been occasionally alarmed by pains, yet no other manifestations of disease have appeared.

As I have preserved no notes, and do not perfectly recollect any case of a tumour of this structure occurring in a distinct form, unless some of those about the breast may be so considered ; and as I wish to show that all these diseases occur distinctly as well as in glands, I shall, as an instance of a pancreatic appearance in a distinct tumour, refer the reader to the curious Case published in London by Dr. Bouttatz of Moscow, of a tumour which grew beneath the conjunctiva of the eye, and protruded it between the eyelids. The tumour was seven inches long and three inches and a half in circumference, and weighed two pounds and a half. The structure, which is represented in a plate, answers correctly to that which I have denominated pancreatic ; and it had also the ordinary characters of this diseased structure, which are those of slowly and regularly increasing, not being prone to inflammation, nor tending to suppuration. The tumour, as might be naturally supposed, was closely connected with the tunica conjunctiva against which it pressed, but the base of it was easily elevated from the cornea which still retained its natural transparency, and the patient regained his sight on its removal.

Cystic Sarcoma.

The next species of sarcomatous tumour, as it contains cells or cysts, may be named Cystic Sarcoma ; and this

species will be found to comprehend varieties. This species sometimes occurs as a distinct tumour, but is more frequently met with in the testis and ovary. In one kind of disease of the testis, the part is perhaps enlarged to six times its natural size, and consists of a congeries of cells, containing a serous fluid; their size is that of currants or grapes, but of an oval figure. The sides of the cysts are so vascular as to be made red by injection; and sometimes the injection is even effused and tinges the contents of the cyst. Dr Baillie has favoured us with an elegant and correct representation of this disease in his Series of Engravings intended to illustrate the Morbid Anatomy of some of the most important Parts of the Human Body.* I have known this alteration of structure the consequence of a blow received on the part: but, in general, it occurs without evident injury. The firm or sarcomatous part of an ovary affords a good specimen of the structure I am describing; the cells are here much larger, and are so vascular as to be made quite red by injection.

To show that this structure is not peculiar to these parts, I may mention the following case: a tumour was taken from the face of a boy by Sir Charles Blicke, which, when divided, was found to consist entirely of an assemblage of cells filled with a watery, yet coagulable fluid.

In the testis, cysts are not unfrequently found containing a kind of caseous substance. In this case, too, the sides of the cyst are vascular. The cysts are generally large, and sometimes there is but one. I have called the substance caseous, because it resembles cheese in consistence, and in

* *Vide* Fasc. 8. plate 8. fig. 2.

colour; being of a yellowish cast, and of an unctuous appearance; but it is not at all unctuous to the touch. It may be proper to mention, that this caseous substance is sometimes irregularly distributed throughout the vascular substance of a diseased testis, without being confined in distinct cysts. I believe this kind of sarcocele is particularly unyielding to medical treatment.

Mammary Sarcoma.

There is a species of sarcomatous tumour, which indeed I have not frequently met with, but which so strikingly resembles the mammary gland in colour and texture, that, wishing to distinguish it on account of the following case, I have named it Mammary Sarcoma.

I have seen this substance (which is white and firm, and has a similarity of appearance throughout) in the midst of adipose tumours; but my attention was not particularly excited to it till the following case occurred.

CASE VI.

A moderately healthy middle-aged woman came from the country to St. Bartholomew's Hospital on account of a tumour of the size of a very large orange, which had grown gradually on the front of her thigh: it lay beneath the integuments and above the fascia. It was removed by an operation, and the integuments covering the tumour were also taken away, as in the removal of the cancerous breast. The sides of the wound were brought together by sticking plaster, and, at first, seemed disposed to heal; but after-

wards a considerable induration of the surrounding parts took place, and the wound degenerated into a malignant ulcer, which spread extensively, and was incorrigible by any medical means employed. As the ulcer spread, so, in the same proportion, did the hardness of the parts which surrounded it. The pain and fever so exhausted the patient, that in about two months she died.

This tumour, the appearance of which was exactly of the kind that has been described, seemed to have no distinct capsule, but to be gradually lost in the surrounding parts. The whole of the diseased part seemed to have been removed, yet it is probable that the contiguous parts had a disposition to disease, which was aggravated and rendered more malignant, by the injury of the operation. Could the circumstances have been foreseen, it might have been right to have removed the parts surrounding this tumour more extensively, as suggested in one of the preliminary observations.

There is a similar kind of diseased structure, but of a softer texture, which is frequently found as a distinct tumour, or in glandular parts perhaps; which might, with propriety, be considered as a variety of the same species of sarcoma. It has the same uniformity of surface, but it is not always of a white colour, being occasionally of a brownish or reddish tint. I have seen a substance of this kind forming a tumour surrounding and compressing the œsophagus, and causing a contraction of that tube. I have seen this kind of sarcoma in glandular parts, in which the progress and event of the case did not indicate the disease to be of a noxious nature. The general result of my observations, however, has induced me to believe, that this dis-

eased structure is prone to degenerate into an intractable ulcer, which will communicate its disease to the surrounding parts, and I have therefore placed this species of sarcoma between those which seem to possess no malignity, and those which follow, and which are of a very destructive nature.

I add the relation of a Case which occurred at St. Bartholomew's Hospital, since the publication of the former edition of this paper.

CASE VII.

A woman about fifty years of age had a tumour growing beneath the skin of the perinæum, that by the side of the rectum, and that which is external to the labium. It was about seven inches in length, about two in breadth, and descended as low as the middle of the thigh. Sir Charles Blicke removed it, by dividing the skin on either side of the tumour lengthwise, at the upper part of it. He then dissected out the upper part of the tumour, which was thin, from beneath the divided integuments, and brought the parallel edges of the skin together by two sutures. The tumour, when removed, being divided, appeared firm, white, and smooth, and strikingly resembling the mammary gland. It had no distinct capsule. The integuments adjoining to the tumour inflamed, and indurated, and ulcerated, and a very large and foul sore was formed. The patient's health became greatly deranged, so that little or no hopes were entertained of her recovery. However, after a time, the disease ceased to spread, and at the end of about three weeks began to amend. The constitution became tranquil in proportion, and the sore slowly healed.

Tuberculated Sarcoma.

The next species of sarcoma, which I have to describe, may be named Tuberculated Sarcoma. It consists of an aggregation of small, firm, roundish tumours, of different sizes and colours, connected together by a kind of cellular substance. The size of the tubercles is from that of a pea to that of a horse-bean, or sometimes larger; the colour of a brownish red, and some are of a yellowish tint. In Dr. Baillie's Plates there is one of the tuberculated liver,* which expresses the appearance of this kind of sarcoma as well as can possibly be done by an engraving.

The instances which I have seen have been chiefly in the lymphatic glands of the neck. The tumours have ulcerated; have become painful and intractable sores; and have destroyed the patient. The disease appears to possess a very malignant nature.

CASE VIII.

A remarkable case of this kind occurred in St. Bartholomew's Hospital, in 1797. A man between forty and fifty years of age had a large tumour at the side of his neck, beneath the platysma myoides. It measured about eight inches in length, and four in breadth. It was hard and irregular on the surface, seeming like a cluster of diseased lymphatic glands. It was extremely painful, and had greatly impaired his health. He affirmed that it had not been more than six months since its first appearance, and in the course of this time, numerous small tumours of similar den-

* *Vide* Fasc. 5. Plate 2

sity and structure had grown beneath the skin all over the trunk of the body, but chiefly on the neck and abdomen. The skin and the front of the tumour in the neck had ulcerated, and become a painful phagedænic sore; and the patient died with hectic fever, in about six weeks after his admission into the hospital. The structure of all the tumours was alike, and such as has been described: the body was examined by the students of the hospital, who said that there were no tubercles on the viscera, as there commonly are in cases of this disease.—As this disease is uncommon, it may not be improper to relate another case on which I was consulted in the course of the last year.

CASE IX.

A gentleman had a tumour in the lymphatic glands of the axilla, which he had taken notice of about a month, and which was supposed to be of a scrofulous nature. I was consulted as to the propriety of his going to the sea-side. The tumour was of the size of an egg, and its surface was irregular from the projection of numerous tubercles. The circumstance struck me, and led me to enquire if he had no other little tumours in the skin. He told me there was one in the groin, which appeared on examination to be a distinct tubercle; and on further enquiry, I found that the glands above the collar-bone by the side of the neck, were in some degree affected. I had no doubt of the nature of the disease, and told the physician, that, in my opinion, it would terminate fatally. After about a fortnight, when I saw the patient again, these tubercles had multiplied all over the skin, both in the front and back part of the body; they were hard and painful, and gave him the sensation as if he was lying on a number of hobnails. The

disease in the glands, both below and above the collar-bone, had greatly increased, and the arm was very œdematous. The disease progressively increased; the skin seemed to peel off in thin sloughs from the surface of the enlarged glands in the axilla; but no sloughing or ulceration had taken place in the tumour when the patient died, which was about five weeks after I first saw him. On examining the body, the tubercles every where had the appearance which has been described; and many similar tubercles were found on the surface of the lungs, heart, liver, spleen, omentum, and mesentery. The absorbent glands of the mesentery, and the other internal absorbent glands were, however, unaffected.

Since the above account was written, I examined a body in which such tubercles were found very generally scattered beneath the skin. The patient was said to have died of a cancerous uterus, and the cervix was in a state of ulceration. The whole uterus was diseased, and the parietes were an inch in thickness. The disease, however, was not carcinomatous. From this case, as well as from, others, which are related, it appears, that the same disorder of the general health may produce local diseases of a dissimilar appearance or nature.*

* Since the publication of the former edition, I have seen a case, which is to me so singular, that I wish briefly to mention it. A gentleman had a spot in the skin, opposite to the inferior angle of the scapula. It had the appearance of one of those spots called petechiæ, It enlarged, thickened, and ulcerated. The ulcer became foul and intractable and the patient came to London with his health much disordered, apparently from local irritation. The axillary glands became affected, and enlarged to a considerable size, and suppurated. Smaller spots resembling petechiæ came out in various parts of his body. He took medicines with a view to regulate and improve the functions of his digestive organs, which were much disordered. His general health improved, and under this change the original ulcer greatly amended in its appearance; the spots remained sta-

Pulpy or Medullary Sarcoma.

The sarcoma which is next to be described is generally found in the testis, and is distinguished by the name of the soft cancer of that part The term cancer is objectionable because it conveys an erroneous idea of its nature ; for this disease, though perhaps equally destructive, will be shown to be unlike cancer in its nature and progress.

The tumour, in those cases of the disease which I have most frequently met with, has been of a whitish colour, resembling, on a general and distant inspection, the appearance of the brain. The disease is usually of a pulpy consistence ; and I have, therefore, been induced to distinguish it by the name of medullary sarcoma. Although I have more frequently met with this disease of a whitish colour, yet I have often seen it of a brownish red appearance. Which is most common I cannot decide : the structure and feel of both are the same, and their progress is also similar ; they are, therefore, to be considered as varieties of one species The shortest way in which I can communicate a knowledge of this disease, and render those remarks which I have to make on it intelligible, will be, by relating a case in which it proceeded to a very considerable extent before it destroyed the patient.

CASE X.

A tall healthy-looking man, about forty years of age, had, about fifteen years before, a swelled testicle from a gon-

tionary ; the parts in the axilla became so far sound, as to make it nearly certain that they had been affected only by common irritation, and not by a specific disease. This tranquil state lasted about six weeks, when the original ulcer became worse ; and by the aggravation of that disease, without any increase of the others, his powers became exhausted, and he died.

orrhœa; the epididymis remained indurated. Six years afterwards it became enlarged, and a hydrocele at the same time formed. Half a pint of water was discharged by a puncture, but inflammation succeeded the operation and this testis became very large. An abscess formed, and burst in the front of the scrotum, and the testis subsided in some degree. Mercury was employed to reduce it, but without effect. The part, however, was indolent, and gave the patient no trouble but from its bulk.

About a year afterwards a gland enlarged in the left groin (the same side as the testis): another then became swolen in the right groin; and in the course of two years, several glands in each groin had obtained a very considerable magnitude. At this period he was admitted into St. Bartholomew's Hospital, under the care of Mr. Long. The testis was, at this time, between four or five inches in length, and about three in breadth; it resembled its natural form, and was indolent in its disposition. The spermatic chord was thickened, but not much indurated. Four or five glands where enlarged in the groin on both sides; each of which was of the size of a very large orange; and, when observed together, they formed a tumour of very uncommon shape and magnitude.

They gradually increased in size for several months, till at last the skin appeared as if unable to contain them any longer. It became thin, inflamed, and ulcerated; first in the left groin, and exposed one of the most prominent tumours. The exposed tumour inflamed and sloughed progressively, till it entirely came away. As the sloughing exposed its vessels, which were large, they bled profusely, insomuch that the students endeavoured, but in vain, to

secure them by ligatures: for the substance of the tumour was cut through, and torn away in the attempt. Pressure by the finger, continued for some time, was the only effectual mode of restraining this hæmorrhage.

The loss of one gland relieved the distended skin, which had only ulcerated on the most prominent part of the tumour, and had not become diseased. It now lost its inflamed aspect; granulations formed, and a cicatrix took place. In the opposite groin a similar occurrence happened. One gland, exposed by the ulceration of the skin, sloughed out, being attended by the circumstances just recited. However, before the skin was cicatrized, ulceration had again taken place in the right groin, in consequence of the great distension of the skin from the growth of the tumour; and sloughing had begun in the tumour, when the patient, whose vital powers had long been greatly exhausted, died.

The testis was injected, and, when divided, was found to be of a whitish colour, and moderately firm consistence, and was made red by the injection in various parts. The tumour, formed by the inguinal glands on each side, was as large as a man's head, and the structure was very similar to that of the testis, but more pulpy. On opening the body the pelvis was almost filled with similarly diseased glands, and the vertebræ were hidden by others as high up as the diaphragm. The disease in the upper ones was not, however, so far advanced as in the others: some of the former, which lay close to the diaphragm, and were not larger than a walnut, being cut into, a thick fluid, resembling cream in colour and consistence, escaped, and was expressed, and the gland was left a contexture of loose fibrous substance.

The state of the glands newly affected shows, that the actions of this disease cause a secretion of fluid like cream; that this fluid acquires consistence during its residence in the part; and that it is the cause of the increase of size in the gland. The profuse hæmorrhage, which took place during the sloughing, shows that there is an increase of vessels proportionate to the augmentation in bulk of the diseased part. The simple ulceration of the skin from distension and the subsequent healing of the ulcer show that this morbid affection is unlike carcinoma, which communicates its disease to all contiguous parts; neither has it the hardness nor the disposition to ulcerate, which characterize cancer. The general disease of the absorbing glands shows that the diseased action is readily propagated in the course of those susceptible vessels; and the glands of the pelvis being affected equally with those higher up, renders it probable that it induces the disease, as well by imparting irritation to them, as by furnishing a matter capable of stimulating them when they have imbibed it; an opinion that will be more strikingly verified by the next case which I shall relate.*

This species of sarcoma, though it usually affects the testis, occasionally occurs in other parts. I shall authenticate this fact by the brief relation of another case, which will serve also to throw additional light on the nature and progress of this disease.

* The progress of what is called the scirrhous testis, is similar to that of the disease which I am describing, and of course very different from that of genuine carcinoma. It is not improbable, that from the similarity of the progress of these two diseases, and the equal fatality having been remarked, they first acquired the contrasted names of soft and hard cancers of the testis.

CASE XI.

A boy, about twelve years of age, was brought to the hospital for advice, on account of a tumour in the front of his thigh; it had been growing three or four months, and had then attained the size of a large orange. The base of it was situated close upon the bone. It increased, notwithstanding applications that were employed to disperse it, and the patient became confined to his bed. After some time the leg became œdematous to a very great degree; the inguinal glands were enlarged, but not in a degree proportionate to the œdema, none of them having attained to more than the size of a small walnut. The parts in the ham were also considerably swoln. In a short time the cause of the great degree of œdema was manifested; for the lower part of the abdomen became distended by a tumour, that seemed to rise out of the pelvis and compress the illiac vessels. The boy's health, as may be supposed, gradually declined, and, when the disease had attained to this state, he died.

On examining the parts it was found, that the tumour, though it lay close to the periosteum of the thigh-bone, had no connection with it; that it was in structure like the disease last described; and that the disease had extended, through the medium, and in the course of the absorbing vessels, downwards to the ham, where the glands were enlarged, and formed a considerable tumour; and upwards into the pelvis, where the internal illiac glands more than filled one side of that cavity, rising out of it, as has been said, so as to distend the lower part of the abdomen. The disease had also extended so as slightly to affect the lumbar glands. The tumours in the ham and pelvis were of the

same structure as the original tumour. The inguinal glands, though affected apparently by the same disease, were not considerably enlarged.

This case also shows the uncommon facility with which this disease is propagated along the absorbing vessels; and its having extended downwards to the ham, as well as upwards into the pelvis, confirms the opinion, that it extends itself by imparting irritation to the vessels, as well as, perhaps, by furnishing a matter, which, if imbibed, may communicate the same irritation.

I have mentioned, as a variety of this disease, that in which the colour is different, it being between a brown and that of the blood; but in texture and organization it does not appear dissimilar. It seems, therefore, as if the diseased action caused the secretion of a fluid, sometimes of a milky, sometimes of a more dusky hue; which gradually acquires solidity, and augments the bulk of the part. The diseased part acquires in general a considerable solidity when it has continued for some time, so as scarcely to deserve the names of soft cancer, or medullary sarcoma. The hardness is also, in some instances which I have seen, increased, apparently by a thickening of the cellular substance which pervades the gland.

It seems probable, however, that the same kind of diseased action may not be always followed by the like alteration of structure, in the part which it affects. Sir Astley Cooper, in his Paper on Obstructions of the Thoracic Duct, mentions an instance in which matter imbibed from a testis affected with a disease like the present obstructed that vessel. His description of the testis is, that it was "a

pulpy mass, composed of broken coagulable lymph, and blood-coloured serum."*

I remember one instance of the inguinal and lumbar glands being affected with a disease similar to those just described, from a diseased testis of a different structure. The testis was removed in the Hospital, and was found much enlarged, and vascular throughout, except where some soft cheese-like matter was deposited. Some of the inguinal glands enlarged, ulcerated, and sloughed out, and the wound seemed disposed to heal. The lumbar glands were affected, became extremely painful, and the patient being previously much exhausted, sunk under this last complaint.

He had been removed to some distance from the Hospital, and I could not obtain permission to examine the body till four days after his decease. I took out the lumbar glands and put them in water; and, the weather being extremely hot when I examined them the next day, I found that all the unorganized deposited matter which had enlarged them had become putrid, and was washed away, leaving the capsule of the gland, and a congeries of flocculent fibres occupying the interior part of it; these were doubtless the vessels and connecting cellular substance of the glands, not indurated (as I have seen it in some other instances) by inflammation.

In the advanced stage of this disease, sometimes lymphatic glands out of the course of absorption, and of the participation of irritation, become affected with the same

* *Vide* Medical Records and Researches, p. 96

disease; and a secretion of this thick cream or bloody-coloured fluid takes place on the surface, or in portions, even in the liver or lungs, or other viscera. I have heard this circumstance accounted for, by supposing that the absorption of the matter deposited in the originally diseased parts was so abundant as to induce the necessity of depositing it in various places; but it seems to me more rational to attribute it to the prevalence of the same diseased disposition throughout the body. For we frequently find, that solid tumours of similar structure exist in various parts of the same subject; and sometimes they rapidly multiply as the disease advances, as was mentioned in the case which is related of tuberculated sarcoma.

Carcinomatous Sarcoma.

The last species of sarcomatous tumour which I have to describe, is the Carcinomatous. It is not here designed to give a full or distinct history of Carcinoma, but only a general and comparative account of those circumstances in which it resembles or differs from other tumours. This kind of tumour, on account of its peculiar hardness, is emphatically termed Scirrhus, while it remains entire and free from ulceration. But the word scirrhus is frequently applied to other indurations, and it seems better, in order to avoid ambiguity, to use the same term to denote all the stages of this disease, naming it carcinoma, in the first place, and ulcerated carcinoma when that change has occurred. This disease is not, in every instance, so peculiarly hard as to entitle it to the name scirrhus; and however indurated it may be, it still must be accounted a kind of fleshy tumour; therefore I may be allowed to call it carcinomatous sarcoma.

I shall arrange the observations which I have offered under three heads; 1st, The history of carcinoma; 2dly, Its anatomical structure; and, 3dly, I shall compare this disease with others which resemble it. I shall suppose the carcinoma to arise in the female breast, as there it most frequently occurs, and can be best investigated.

It sometimes condenses the surrounding substance so as to acquire a capsule; and then it appears, like other sarcomatous tumours, to be a part of new formation: in other cases the mammary gland seems to be the nidus for this diseased action. The boundaries of the disease cannot be accurately ascertained in the latter case, as the carcinomatous structure, having no distinguishable investment, is confused with the rest of the gland. In either instance carcinoma begins in a small spot, and extends its progress from thence in all directions, like rays from a centre. This observation will serve to distinguish it from many other diseases which, at their first attack, involve a considerable portion, if not the whole of the part where they occur. The progress of carcinoma is more or less quick in different instances. When slow, it is in general unremitting; at least I am inclined to think that the disease, though it may be checked, cannot be made to recede by that medical treatment which lessens the bulk of other sarcomatous tumours. This circumstance affords, in my opinion, another criterion, by which it may, in general, be distinguished. This obdurate and destructive disease excites the contiguous parts, whatever their nature may be, to the same diseased action. The skin, the cellular substance of muscles, and the periosteum of bones, all become affected, if they are in the vicinity of cancer. This very striking circumstance in the history of carcinoma distinguishes it from

most of the diseases already described. In the pulpy sarcoma the disease is propagated along the absorbing system, but the parts immediately in contact with the enlarged glands do not assume the same diseased actions. Neither in the tuberculated species does the ulceration spread along the skin, but destroys that part only where it covers the diseased glands.

It was observed by Mr. Hunter that a disposition to cancer exists in the surrounding parts, prior to the actual occurrence of the diseased action. This remark, which is verified by daily experience, led to the following rule in practice: "That a surgeon ought not to be contented with removing merely the indurated or actually diseased part, but that he should also take away some portion of the surrounding substance, in which a diseased disposition may probably have been excited." In consequence of this communication of disease to the contiguous parts, the skin soon becomes indurated, and attached to a carcinomatous tumour, which, in like manner, becomes fixed to the muscles, or other parts over which it was formed.

As a carcinomatous tumour increases, it generally, though not constantly, becomes unequal upon its surface, so that this inequality has been considered as characteristic of the disease; and it is a circumstance which deserves much attention. A lancinating pain in the part frequently accompanies its growth, but in some cases this pain is wanting. It attends also on other tumours, the structure of which is unlike carcinoma; of which I have given an instance in speaking of pancreatic sarcoma. This cannot, therefore, be considered as an infallible criterion of the nature of the disease.

In that kind of cancer, from which this description is taken, the diseased skin covering a carcinomatous tumour generally ulcerates, before the tumour has attained any great magnitude; a large chasm is then produced in its substance by a partly sloughing and partly ulcerating process. Sometimes, when cells contained in the tumour are by this means laid open, their contents (which consist of a pulpy matter of different degrees of consistence, and various colours,) fall out, and an excoriating ichor distils from their sides. This discharge takes place with a celerity which would almost induce a person ignorant of the facility with which secretion is performed to believe that it cannot be produced by that process.

When the diseased actions have, as it were, exhausted themselves by their vehemence, an attempt at reparation appears to takes place, similar to that which occurs in healthy parts. New flesh is formed, constituting a fungus of peculiar hardness, as it partakes of the diseased actions by which it was produced. This diseased fungus occasionally even cicatrizes. But though the actions of the disease are thus mitigated, though they may be for some time indolent and stationary, they never cease, nor does the part ever become healthy.

In the mean while, the disease extends through the medium of the absorbing vessels, and the glands in the axilla become affected. The progress of carcinoma in an absorbent gland is the same as that which has been already described. The disease is communicated from one gland to another, so that after all the axillary glands are affected, those that lie under the collar bone at the lower part of the neck, and upper part of the chest, become disordered.

Occasionally a gland or two become diseased higher up in the neck, and apparently out of the course which the absorbed fluids would take. The absorbent glands, in the course of the internal mammary vessels, become affected as the disease continues. In the advanced stage of carcinoma a number of small tumours, of similar structure to the original disease, form at some distance, so as to make a kind of irregular circle round it.

Here it is no wonder that I conclude the account of the dreadful effects of this pernicious disease. For when it has done so much mischief, the strongest constitutions sink under the pain and irritation which the disease creates, aggravated by the obstructions which it occasions to the functions of absorption in those parts, the vessels of which lead to the diseased glands. Towards the conclusion of the disease the patient is generally affected with difficulty of breathing and a cough. In cases where the external disease has been removed, the same symptoms of disordered respiration takes place, and the patients die of internal diseases.

It has been a subject of debate and consideration, whether the disease of the absorbent glands, which takes place in carcinoma, be the effect of the stimulus of matter imbibed by those vessels from the original disease, or of irritation propagated along them. The reason for supposing that no poison is imbibed is, that, if it were conveyed into the blood, it would produce general disease in the constitution; but no more fever or general disorder is found to exist in carcinoma than what would naturally be produced by the irritation which the affected parts occasion. It does not seem essential to my present design to discuss

this subject at length: it is however right to observe, that we scarcely ever see glands diseased out of the course which the absorbed matter would naturally take, though they are affected in this manner in diseases which can be propagated by irritation. When the glands of the axilla are obstructed by disease, the absorbed matter will pass by anastomosing channels, into the internal mammary absorbents, and if occasionally one or two glands in the neck are found diseased, they may become affected in the same manner, by the fluids being obliged to take a circuitous route.*

There is another circumstance in the history of cancer, which deserves attention and investigation; that is, whether a disease not originally cancerous can become so in its progress? We can only form our opinions on this subject from analogy and observation. Analogy leads us to believe, that such an alteration in the diseased actions may readily take place. Venereal buboes often change their nature after the administration of mercury, and become troublesome sores, to which that medicine is rather detrimental than beneficial. Injuries induce inflammation and enlargement of parts, which afterwards degenerate into scrofulous diseases. But, though analogy seems so strongly to favour the opinion, I cannot take upon myself to say, that my observations have confirmed it. When tumours have been removed, the history of which corresponded to that of cancer, a cancerous structure was observed in them; and on the contrary, in diseases of an apparently different

*It may be proper to enquire, whether those tumours, which arise in the circumference of carcinoma, are not caused by the absorbed matter being made to stop for a time in the vessels, and thus to afford that irritation which induces disease in them and the contiguous parts?

nature, a different organization has been found. I once, indeed, assisted at an operation where the tumour was of that kind which I have denominated pancreatic; and I heard afterwards, that the patient died in the country of a disease which was reputed cancerous. Again, in investigating this subject, it deserves to be remarked, and every surgeon must, I believe, be familiarly acquainted with this fact, that many diseased tumours remain in the breast for a great length of time, perhaps during life, without undergoing any change in their nature; or, in other words, without becoming cancerous.

It is difficult to convey correct ideas of the structure of carcinoma by words, or even by drawings. In the generality of instances the diseased part is peculiarly hard, and there are intermixed with it firm whitish bands, such as Dr. Baillie has described and represented in his Book and Plates of Morbid Anatomy. There is indeed no other striking circumstance, which can be mentioned as constantly claiming attention in the structure of this disease. These firm whitish bands sometimes extend in all directions from the middle towards the circumference of a carcinomatous tumour, like rays from a centre, having little intervening matter. Sometimes they intersect it irregularly, having interposed between them a firm brownish substance, which may be scraped out with the finger. Sometimes they form cells containing a pulpy matter of various colours and consistence; and sometimes these bands assume an arborescent arrangement, ramifying through the diseased substance.

Firm white bands, like thickened and compact cellular substance, are seen as the disease advances, to extend themselves from the original tumour amidst the fat in which

it is occasionally imbedded, intercepting portions of fat in the irregular areolæ which they form. This circumstance deserves consideration on account of its practical application; for if, after removing a carcinomatous tumour, the surgeon attends to the part which has been taken away, he will see if any of these bands have been cut through, and, consequently, whether some of this diseased substance, which ought to be removed, has not been accidentally left. This circumstance cannot be observed by looking at the bleeding surface of the wound, but may be readily ascertained by examining the part which has been removed.

These are the chief circumstances, which I think sufficiently characterize carcinoma, and distinguish it from other sarcomatous tumours. The account of them is brief, and much has been omitted, because it was not designed particularly to discuss the subject of carcinoma, but merely to point out its distinguishing characters. I now proceed to speak of diseases resembling cancer; though, in so doing, I shall digress a little from the principal subject of this paper, that is, to describe the distinguishable kinds of sarcomatous tumours, and give their history.

According to the preceding account, carcinoma, begins in a small scirrhus, which gradually enlarges and afterwards ulcerates. It does so in the breast, lip, tongue, and cervix uteri; yet it may be enquired if it does so in every instance. Parts sometimes superficially ulcerate at first, and afterwards acquire surrounding hardness, and strikingly resemble carcinoma, if they do not strictly deserve that name. This is the way in which some of those diseases proceed, which occur near the side of the nose or eye, and which gradually destroy the parts in which they are situated, and cannot be cured by any mode of local or general treatment.

The intelligent reader will not suspect me of confounding these more malignant diseases with some herpetic ulcerations of the nose, in which the morbid actions gradually cease, and the first affected parts get well, whilst the surrounding parts become diseased. I have known diseases beginning in ulceration, and followed by induration, and the growth of fungus extend themselves unremittingly, so as to destroy the patient. I have seen diseases of this description occur in the labia pudendi, some of which have terminated fatally, whilst others were removed even at an advanced period of the disease with success.

Here some additional discriminating circumstances seem to be wanted, by which we may distinguish between these ulcers and common carcinoma. I have never remarked, that such ulcers have affected the absorbent glands, though I do not feel assured that this occurrence never takes place. It therefore remains to be determined by future cases, how far this circumstance may enable us to decide on the nature of these diseases. I shall next relate the principal circumstances of a remarkable case of this kind of disease, which will serve to elucidate the subject, and also to exhibit a specimen of the diseases to which I allude.

CASE XII.

A man was admitted into St. Bartholomew's Hospital with a tumour beneath the jaw, having a great degree of surrounding hardness, and containing three cells, like those of carcinomatous tumours. The history which he gave of the disease was very curious; he said that a redness took place superficially in the skin, which gathered and burst, and discharged good matter; that the opening enlarged,

and the surrounding parts indurated, and thus produced an appearance like a cell in a carcinomatous tumour; then, another portion of skin became diseased in the same manner, and with the same consequences, till, by degrees, the general tumour had acquired its present magnitude. To the truth of this account we had an opportunity of bearing testimony; for this occurrence took place twice in succession during his residence in the Hospital; and thus two more cells were added to the general mass. The inflammation of the skin, and the suppuration, which was healthy in appearance, took place beneath the tumour, and made it reach almost as low as the sternum. As the patient's health had considerably declined by the irritation of the constitution which this disease kept up, and as no amendment of the disease had taken place in consequence of the applications or medicines which were employed, he left the Hospital, and went into the country.

Diseases also, which strikingly resemble carcinoma in appearance, form in the following manner. An enlarged lymphatic gland shall gradually become soft, and contain a fluid. In this state it ulcerates or is opened; but instead of subsiding, it inflames; the surrounding parts become indurated; the integuments acquire a dusky hue; the opening and cavity enlarge, and assume the appearance of a cyst, from the sides of which fungus arises, and turns over the everted edges of the opening. I have also seen, after the bursting of an encysted tumour, the surrounding parts indurate, and throw out a fungus, forming a disease appearing like cancer, and which could not be cured.

Are such diseases as I have here described to be accounted carcinomatous? If not, what are the characters

which discriminate between them and carcinoma? As I have no precise or satisfactory information to communicate, I forbear to say any thing on the subject.*

Since the first edition of these observations, several publications have appeared on the subject of cancer, and as there are many circumstances relating to its history, upon the determination of which, by general observation and experience, our practical rules of conduct must be founded, I take this opportunity of presenting to the public some additional observations with respect to it, without presuming to comment on the opinion of others. I shall also in this account confine myself to the disease, as it appears in the female breast.

The account of carcinoma that I have already given, is taken from the most strongly characterized specimen of the disease occurring in that part, which is peculiarly hard, and rarely attains considerable magnitude. There are, however, varieties; and one of the most remarkable is, that of the disease attaining a very considerable size before it ulcerates. In this case sometimes the integuments re-

* A patient was admitted into St. Bartholomew's Hospital, with several indurated foul but small sores, about the bend of the elbow, and some which intervened between it and the axilla. The axillary glands were much diseased, and the arm was swollen and hard. She said that the sores began like common gatherings, and that they hardened after the skin had given way. That the disease began in superficial sores, and that the axillary glands were next affected.

The patient died in the Hospital; and on examining the limb, a great number of tubercles were found in it, several of which were imbedded in the nerves of the arm. The lung also contained a great number of tubercles, which appeared to be the effect of the same kind of disease affecting that part.

main pale and pliant, and a surgeon who first sees the breast in this state, may doubt whether the disease be actual cancer or common sarcoma. The substance of the tumour is also much less hard than in the specimen first described; yet it is more compact and weighty than most other diseases of the same bulk which are not carcinomatous. If at first a surgeon may hesitate to decide upon the nature of this disease, his opinion will in general be speedily determined by enquiry and examination. If the history of the disease accords with that of carcinoma, that is to say, if it began in a small district, and regularly and unabatingly attained its present magnitude; if the surface of the tumour be unequal, having in various parts produced roundish projecting nodules, the disease will almost invariably be found to be carcinoma. The skin will soon adhere to one or more of these prominences; it will ulcerate and expose the subjacent parts, and the future progress of the disease will so exactly accord to that of the harder and smaller specimen which I have described, as not to require a separate description. In general, however, the absorbents are much less liable to become affected in the latter variety of this disease.

Having thus represented the extreme varieties of carcinomatous diseases, I need scarcely observe that there will be intermediate degrees. In carcinoma, as in other diseases, it appears to me, that the history and progress is more declarative of its nature than any circumstance which we may be able to discover by the sight or touch.

There is one circumstance in the history of carcinoma which may prove very perplexing to the observer and tend

to induce him to disbelieve that there is any regular progress belonging to this disease. I allude to the occurrence of cancer in parts previously diseased in another manner. Analogy, as I have said, would induce us to believe, that this might be a frequent occurrence; yet I cannot say that my observations have led me to think that it very commonly takes place. Cases of tumours, which have remained indolent for twenty or more years, becoming cancerous at an advanced period of life are not unfrequently met with; and when tumours form in or about the breast at an advanced period of life, though the progress at the beginning may assure us that they are not carcinomatous, yet they may become so, after the lapse of but a few years, or even a shorter period of time. The impression which the consideration of such circumstances has left on my mind (in conjunction with the information which I think I possess relative to the general health of a patient liable to cancer, and which I will presently communicate,) is, that the patients who are subject to such an occurrence might have been liable to the formation of a cancerous disease at the same period, even if no diseased structure had previously existed, and formed a nidus for the cancerous actions. That they are more likely to begin in parts previously diseased, I readily admit; and that it may be prudent and proper to remove such diseases as I now allude to, under the circumstances which I have mentioned, and shall still further describe, is an opinion in which I readily concur; yet, if an idea, that most or many diseased structures might become cancerous was generally prevalent, it would doubtless lead to the performance of many unnecessary operations.

In the first volume of these Observations, I have given an opinion, which I am inclined even more fully and strongly to repeat, that a great number of tumours in and about the female mamma arise from a disordered state of the health in general, and consequently that the most judicious and effectual mode of dispersing them, is by correcting that general disorder. Such cases are very numerous, and very important, as the reader may see, by referring to the few that I have printed; yet all, or most of these, would be consigned to removal by the knife, were the idea which I have mentioned to become prevalent. When, however, a tumour that cannot be dispersed by the means to which I now refer exists in or about the breast, and which we feel assured is not of a carcinomatous nature, it may be well to remove it, because it is often a constant source of disturbance and alarm to the patient's mind; and, I am ready to admit, that it is likely to be a nidus in which cancerous actions may be engendered in a constitution predisposed to that disease. However I feel myself fully warranted in asserting, from my own experience, that many of them will remain in the same state for a great length of time, and even through life, without becoming cancerous.

That cancer, like most other local diseases, owes its origin to a disordered state of the health in general, is an opinion which I do not expect to be controverted. We express it even by saying, that there is a predisposition to cancer. Mr. Hunter was of opinion, that cancer was so far local, that if all the diseased part, or that which was so contiguous to it, as to have felt its influence, and to have acquired a predisposition to disease, were removed, the patient would be as exempt from cancer in that part as if it

never had occurred. This opinion, deduced from his own experience, is very important; it shows us how we ought to operate when an operation is to be undertaken. I am ready to admit the truth of this opinion to the extent affirmed by Mr. Hunter; but though the patient may be as exempt from the disease as if it never had occurred, that state of constitution which induced it originally, may, after a certain lapse of time, cause it to form again,* or may produce the same disease in other parts of the body, or a patient may die of other ills or diseases attendant on a cancerous constitution.

In our present state of knowledge, we are not, I believe, able to distinguish any peculiar circumstance as characteristic of a cancerous constitution. We observe in it those circumstances which indicate a disordered constitution, and augment the disorder by each reciprocally aggravating the other; I mean irritation, weakness, or some undefinable disorder of the nervous functions; and such disorder in the functions of the digestive organs as I have described in the first volume of these Observations. I see persons having the same evident affection of the health in general subject to tumours in and about the breast, which are not cancerous, and to those which are cancerous. What additional circumstances lead to the establishment of cancerous actions in the local disease thus induced we have yet to learn.

* If after the removal of cancer, when the operation has been properly performed, the cicatrix remains healthy for five or six years, or even for a shorter period, and then becomes indurated and carcinomatous, it appears to me more consistent with what we know of the action of this disease to suppose that it has originated again in consequence of the diseased propensities of the constitution, rather than that it has lain dormant so long, and is but now awakened

Previously to the occurrence of cancer the nervous disorder, and that of the digestive organs, have, in general, been greater in degree, and longer in duration, than they are found to be antecedently to other disorders. Some patients having cancer, die of organic diseases in the head or abdomen. If the nervous and visceral disorders are active and considerable, the progress of the local disease will be, in general, proportionately rapid and destructive; and if, on the contrary, these disorders are mild, and less in degree, the progress of the local disease will be proportionally slow and gentle. In confirmation of these observations, I may mention, that I have seen several instances of cancer proceeding so mildly, that the patients have lived many years with little suffering or inconvenience from the local disease, and particularly where attention has been paid to regulate the functions of the digestive organs.*

With a view to impress the contrary fact on the mind of the reader, I will briefly relate two cases in proof of it.

* There can be no subject which I think more likely to interest the mind of a surgeon, than that of an endeavour to amend and alter the state of a cancerous constitution. The best timed and best conducted operation brings with it nothing but disgrace, if the diseased propensities of the constitution are active and powerful. It is after an operation that, in my opinion, we are most particularly incited to regulate the constitution, lest the disease should be revived or renewed by its disturbance. In addition to that attention to tranquillize and invigorate the nervous system, and keep the digestive organs in as healthy a state as possible, which I have recommended in the first volume, I believe general experience sanctions the recommendation of a mere vegetable, because less stimulating diet, with the addition of so much milk, broth, and eggs, as seem necessary to prevent any declension of the patient's strength.

CASE XIII.

A lady came from the country with a cancerous tumour in the breast, and took some medicine, probably arsenic, by the desire of a female quack, which brought on the most violent sickness and purging, with death-like faintings. It was uncertain for several days whether she would survive its effects. Inflammation was induced in the local disease to such a degree, that the cancer sloughed, and came out, and violent erysipelatous inflammation extended itself from the skin of the breast to a great extent. The sides of the cavity, however, threw forth a cancerous fungus, and in this state she returned into the country.

CASE XIV.

A lady about forty-six years of age asked my opinion respecting a small lump in her breast. She was very nervous and agitated, and her bowels extremely disordered. She said she had sometimes twenty discharges from her bowels in twenty-four hours, and that the secretion of bile was as faulty as possible. After about six weeks she called upon me again, having been in the country: the medicines which she had tried had been productive of little or no good. Her conversation was equally desultory and agitated. Her pulse very frequent. The lump was enlarged to about the size of a walnut, but had no signs by which I should have known it to be cancer. Hearing that her surgeon in the country thought it cancerous, and believing that an operation in her present state was inadmissible, I recommended her to take the opinion of another surgeon. I did not now see her for some time, I believe about two months, when the tumour had become as large as an orange, and had

thrown out a fungus, which protruded in nodules. The tumour had, she told me, become soft, and seemed as if it were gathering, and these protrusions took place afterwards. Her general health was still equally disordered, and the surgeon who had seen her concurred with me in opinion, that an operation under her present circumstances was inadmissible. The lump rapidly increased; and, in the course of a few months, became as large as a child's head, having all the characters of carcinoma. It then ulcerated, and did not afterwards materially enlarge. I need not describe how it ulcerated, and how it, occasionally, bled profusely. She gradually became emaciated and feeble, and died exhausted, without the glands in the axilla becoming diseased, or any peculiar symptoms occurring.

In order further to elucidate the opinions which I entertain respecting the constitutional nature of cancerous disease, I select the following case.

CASE XV.

A lady had had a tumour in or near the right breast for more than twenty years, which, when she was between fifty and sixty years, may be said to have become cancerous. The patient indeed insisted, that the cancer did not begin in the original lump, but by the side of it. No local treatment arrested its progress; and, in a short time, it became cognizable from its induration and irregularity of surface, as a decided case of cancer. The tumour, and a considerable portion of the surrounding parts, were therefore removed. The wound healed healthily in a short space of time, and the patient left London. She had always been, to use her own expression, extremely bilious, yet the dis-

charges from the bowels were but rarely tinctured with good bile. She had passed gall stones. Her bowels were very irregular in their functions, being frequently very costive, or the reverse. Whilst I had attended her, she had taken five grains of the compound calomel pill every second or third night, and kept the bowels as regular as possible. She said that her health had been greatly benefitted by these attentions, and I urged her still to continue them. For a year or more, after she left London, she was well, the cicatrix remaining perfectly soft and smooth. Having occasion to travel after that period during the winter, and being badly accommodated at the inns she met with on the road, she caught cold, and became very feverish and unwell. The cold, she said, had fixed itself on the lungs, for a cough, and a difficulty of breathing continued, and increased, so that in a little more than a year from its commencement it destroyed her. About six weeks before her death, she came to London, when she told me, that since the time of her catching her dreadful cold she had found a lump begin to form in her other breast, and that the cicatrix had afterwards become diseased. The tumour in the left breast was of a globular form, of about an inch and a half in diameter; it was hard, weighty, and nodulated upon its surface. It was most characteristically cancerous, but what I should term a dwarf or stunted specimen of that disease, such as we see produced when the powers of the constitution are much lessened. This, and the corresponding fact of cancer diminishing when the powers of constitution decline, should be noted, or else a surgeon might attribute such effects, the consequences of natural causes, to the medicine which he employs. The upper part of the cicatrix, on the opposite side, has indurated and ulcerated, but not to a considerable degree. I was not permitted to ex-

amine the body, which I much wished to have done, because, I believe, the extreme difficulty of breathing could not have been occasioned by any thing less than organic disease of the lungs. I have, however, examined the bodies of cancerous patients who died with difficulty of breathing, without discovering disease in those organs.

The symptoms subsequent to operations, being the result of that excitement of constitution which the thoughts and injury of the operation occasion, often exhibit, in a very striking manner, the diseased propensities of the constitution. I think it may be useful briefly to relate those which occurred after the removal of a cancerous tumour in a case which I lately attended. The patient possessed what might, in general, be called a good constitution, and great fortitude, so that she bore the operation without the least complaint. Yet, during the day preceding the operation, she had a slight lumbago, as she called it, which I believed to be the effect of that anxiety of mind which the thoughts of undergoing the operation must occasion. In the evening after the tumour had been removed, she complained of a desire, and of an inability to void urine; she had also sensations in the throat like hysterics. Her pulse was 80. She had no sleep during the night, but had voided half a pint of urine, which had no striking peculiarity of appearance. Saline draughts had hitherto been given, and she was now desired to take ℥ j of ol. ricini, mixed with mucilage and cinnamon water, every fourth hour till a stool was procured. She took seven draughts without any effect. The pain in the back increased, and during the second night was so severe, that she groaned very constantly from the pain. On the third morning I found her very ill, yet her pulse was not more than 90, neither was her skin

hot. She had voided no urine for the last 30 hours; pain continued from the back down the thighs, but the absence of fever convinced me, that the pain in the back and suppression of urine could not be the effect of nephritis. Thinking, as I had done from the beginning, that the kidneys were sympathetically affected by the state of the bowels, and that the pain of the back depended on the state of those organs, I now ordered her a pill of extract of colocynth, and a draught of Epsom salts, every fourth hour, instead of the castor oil. In the evening, discharges from the bowels took place; she had five stools, and the pain in the back had nearly ceased. Feeling very languid, and having had no sleep during the two preceding nights, she took 20 drops of laudanum, and a little nitrous æther, in water. This medicine produced great heat and uneasiness in the stomach; and though she slept a little from the opium, her sleep seemed to be attended with more disturbance than benefit. She voided some urine during the night, which was like extremely muddy water. As the discharges from the bowels had ceased, and did not seem likely to be renewed, she began again with the castor oil draughts, by which an evacuation of the bowels was procured in the course of the day. The urinary secretion continued, and was augmented in quantity. As the stools were not properly tinctured with bile, three grains of the pilul. hydrarg. were ordered to be given every second night for the future. Dyspeptic symptoms and flatulence now claimed our chief attention. She complained of great acidity, of distention, and tenderness at the lower part of the epigastric region. For this she took chalk mixture, with aromatic confection, and afterwards magnesia; which latter medicine seemed afterwards sufficient to keep the bowels in a gently lax state. In about a fortnight her bowels were in a comfort-

able state, and in about three weeks the urine was clear, and secreted in the usual quantity. On the eighth day, when the dispeptic symptoms were severe, the patient had gout in her finger and toe, to which she had been previously subject. It is right to mention, that prior to the operation, the urinary secretion had never appeared to her to be irregular either in quantity or quality, and that her bowels had been readily affected by rather slight doses of medicine. The same circumstances were observed after the subsidence of the disorder occasioned by the operation. I have satisfaction in adding, that though the wound suffered during the continuance of the constitutional disturbance, it afterwards healed rapidly and smoothly, so that at the end of six weeks it had the appearance of a scar in perfectly healthy parts.

If a cancer be a constitutional disease; if patients affected with it have occasionally other diseases of a fatal nature; if in some instances, when there is no organic disease, the nervous system is so irritable, and the digestive organs so disordered, as to render any operation perilous; these circumstances must render every surgeon who perceives them reluctant to operate, and uncertain as to the event of the case. They show the necessity of solicitously attending to the constitution of the patient after an operation, with a view to prevent the recurrence of the disease, or its formation in other parts. They explain how it happens, that the operation frequently accelerates the death of the patient. I have known a patient die soon after an operation for the removal of a cancerous tumour of no great magnitude, merely in consequence of the shock imparted to the constitution by the operation. I have known other cases, in which the diseased state of the wounded parts seemed to

have been the chief cause of the speedy death of the patient. I therefore concur in opinion with those surgeons, who think, that in many instances an operation for the removal of cancer would be rash and unjustifiable. Yet, however numerous and momentous the deterring reasons may be, I think they should not prevent our operating in many cases. If the whole of these diseased parts, and those which, from contiguity with them, may have been so far influenced as to acquire a disposition to disease can be removed, it surely ought to be attempted, provided the constitution is not so disordered, or diseased, as to prohibit the operation. We ought to bend our minds attentively to make out the characteristic signs of cancer, that we may know it at an early period, and when the disease is in a small compass, and the operation on that account less formidable. To forbear to operate is to consign the patient to hopeless misery.

Fumigations with carbonic acid gas, weak acids, and fresh vegetable juices, correct the fœtor, infusions of opium lessen the pain, and oxyds and saline preparations of iron seem to expedite the destruction of the diseased parts, and cleanse the sore; yet I have not seen any such effects from local applications as lead me even to hope that any may be discovered that will cure the local disease.

The ulceration and self-destroying process of cancer is so horrible a process, that it may be stated as an argument for the operation, that a patient gets rid of a quantity of disease upon easier terms by having it removed by the knife, than by suffering it to proceed in its natural course. When the scar or surface of a wound after an operation becomes indurated and cancerous, the patient suffers much

less pains, and there is much less fœtor in the disease thus formed, so that the patient's sufferings are, on the whole, much diminished. But if the patient's constitution be moderately good, and if the operation be performed at a sufficiently early period, I have known life prolonged for five, six, or more years; and when, after that lapse of time, the cicatrix has become diseased, the actions which ensued have been indolent, and the patients have gradually sunk, and died, rather from some circumstances connected with the state of the general health, than from the degree of the local disease.

There are tumours, the structure of which may not correspond with any of the descriptions that I have given. I feel, however, unable, from my own observations, to depict any other species. It seems to me, that these diseases resemble colours in this respect, that a few of the primary ones only can be discriminated and expressed, whilst the intermediate shades, though distinguishable by close attention and comparative observation, do not admit of description or denomination. There are single tumours, in the composition of which several of the above-described structures may be found, and, perhaps, some part of which may not correspond to any description that has been given. If, however, the history of these dissimilar diseases, which appear in form of tumours, were accurately recorded, and their structure noted, we might perhaps, from the former be led to judge of the latter; and thus attain a knowledge of the intrinsic nature of the disease which would enable us to act rightly in practice.

Encysted Tumours.

In the class of local diseases, and in the order of tumours, custom seems to have placed the genus of En-

cysted Tumours, next to those of the sarcomatous kind. The arrangement, indeed, appears proper; for they are so allied in appearance, and in the sensation which they impart on examination, that they are not unfrequently mistaken for each other; and yet, in general, the encysted tumours have sufficiently distinguishing characters to enable a surgeon to determine their nature prior to the performance of an operation. The discriminating characters are,—a regularity of surface and shape, and a pulpy feel. Yet most surgeons will, I believe, acknowledge that they have seen tumours dispersed, which they have taken for wens; and have even, when they have removed them under that belief, discovered the disease to have been a soft regularly shaped sarcoma, and not a cyst containing a pulpy substance.

Respecting the structure of encysted tumours I have nothing to remark, but what is, I believe, generally known. The cysts most frequently are composed of many lamellæ, which are sometimes so compacted, as to be scarcely distinguishable. These cysts vary considerably in thickness; being sometimes very thick and tough, and at others extremely thin and tender. They sometimes most tenaciously adhere to the contiguous parts, so as to make it difficult to separate them; and, at others, they are so loosely connected, that, when an incision is made which lays bare the cyst, the whole tumour starts out without any dissection.

That the interior surface secretes the contents formed in the cyst, is in my opinion indisputable. That it is a secreting surface I believe; because, when a wen has spontaneously opened by ulceration, I have seen the cyst

produce granulations from its surface. When, also, the front of the bag has alone been taken away, and the skin closed over the back of it, an union takes place between the skin and cyst. When also a wen has burst, or has been punctured, so that a small aperture has been left in it, which has occasionally given discharge to its contents; I have seen the cyst fill repeatedly by a secretion of the same nature, but more fluid than the contents which were at first found in it.

Some notions have of late been entertained, that these cysts may be of the nature of hydatids; it may not, therefore, be improper, in order to enable the reader to form his own judgment on this subject, to mention the following case.

A gentleman had a wen in his cheek, which spontaneously burst, and on which Mr. Hunter tried various stimulating means to induce the cyst to granulate or adhere, so that no further collection might ensue. His endeavours, however, were unavailing; for, after the opening closed, the cavity of the cyst filled again, and the wen was as complete as before, and had increased in magnitude. It was situated unfavourably for removal, and the patient was adverse to an operation. It lay so deeply on the buccinator muscle, as to be as perceptible from the mouth as on the cheek; and there was a great risk of dividing the parotid duct, in an operation undertaken for the removal of the tumour. The deformity which the wen occasioned, was, however, considerable, it being as big as the largest kind of walnut; and the patient was very desirous of having the tumour lessened, though very averse to having it extirpated. He had for this purpose used salt and water.

which made the skin inflame. Having consulted me, I told him that if stimulating applications were to do good, they could only effect it by causing the skin to ulcerate, and the contents of the wen to be discharged, as had formerly happened ; all which might be accomplished in a more direct, and less teazing manner, by just pricking the bag with a lancet, and squeezing out its contents. I thought it also probable, that the small wound would heal, and that the operation might be occasionally repeated. The patient was pleased with the proposal, and it was put in execution. The contents were of the consistence which is termed meliceritous, and had a peculiar odour. No inflammation ensued, and the wound healed ; but, after a little time, it opened again, and gave discharge to a small quantity of watery liquor, of precisely the same odour as the original contents, and the little puncture again closed up. From that time to the present, which is now some years, the wound has occasionally opened, discharging a small quantity of sometimes a more fluid, sometimes a more meliceritous substance ; and, after this discharge, the aperture closes up. This circumstance occurs but seldom ; perhaps every second or third month. The aperture is so small as not to be discernible ; no plaster is worn upon it, and the patient has got rid of a considerable deformity, upon what he thinks very easy and satisfactory terms.

I have mentioned these circumstances to illustrate the functions of the cysts of these tumours ; and to show what may be done in some cases, as a palliation of these diseases. It is not, however, meant to recommend such practice ; for, on the contrary, it will be shown hereafter, that it is dangerous to tamper with encysted tumours ; and, indeed, I should not have ventured on this palliative mode of

treatment, in the case related, had I not known from the effects of the former conduct, which had been pursued, that the cyst and contiguous parts were of an indolent nature, and not disposed to re-act in consequence of violence done to them.

The centents of encysted tumours have been denominated from their consistence, steatomatous, atheromatous, and meliceritous. To this ancient distinction must be added another; the cyst sometimes secretes a substance like nail or horn; which is protruded when the skin ulcerates, hardens, and is pushed forwards in proportion as the cyst secretes more of this substance, so as to appear like horns; as has been shown by Sir E. Home in the Philosophical Transactions.

There is yet another curious circumstance to be noticed with relation to cysts; which is, that they have sometimes hairs growing from their interior surface. This happens in those cysts which are not unfrequently met with in the ovary.*

But though the cysts of encysted tumours must be considered as possessing the organization of other parts, and as secreting and absorbing surfaces; yet their vessels are, probably, very minute, and not endued with a degree of strength adequate to the ordinary reparation of injury. If they produce granulations they are flabby, and the sores are not disposed to heal.

* Some of the tubercles which occur in the viscera seem to be formed by the deposition of various kinds of substances from the surface of a cyst, which appears to be the first formed and most essential part of the disease.

It is no uncommon circumstance to meet with wens, that have burst spontaneously, and have thrown out a fungus, which, like a foreign body, prevents the surrounding integuments from healing.

Most parts that are weak, are irritable when excited, and apt to assume diseased actions. This frequently happens in a striking manner in the cysts of these tumours; and as, perhaps, surgeons are not sufficiently apprized of the bad consequences sometimes occurring from the inflammation of wens, and as it is proper to show the danger of irritating these diseases, I shall relate a few cases to illustrate this fact.

A woman about forty years of age was admitted into St. Bartholomew's Hospital, with a frightful fungus growing on the front of the belly, below, and to the right of the navel. She had been a healthy lusty woman, but was greatly deranged in health by the pain and irritation which this had occasioned. She described it as being a wen which had burst, and her account was afterwards verified by dissection. The fungus bled, and she could scarcely bear the softest dressings to be applied to the part. Nothing mitigated her sufferings so much as lint dipped in a solution of opium, and kept moist by very frequently squeezing on it, from a sponge, a sufficient quantity of the solution. Nothing allayed the constitutional irritation but large doses of opium. She died exhausted in the course of a fortnight.

I removed the cyst from off the aponeurosis of the external oblique muscle, where it covers the rectus, leaving the tendinous expansion quite clean and unaffected. The cyst

had ulcerated in two small places, so that the fungus which it contained was visible from behind.

A man between forty and fifty years of age, who was in St. Bartholomew's Hospital, had a wen on his back, which ulcerated, discharged an atheromatous substance, and afterwards inflamed, and threw out a fungus. Extensive erysipelatous inflammation took place in the surrounding integuments, and his constitution was greatly deranged by irritation and fever. When he was almost exhausted by these circumstances, and before any local amendment had taken place, another wen of the same nature, which he had on his right thigh, ulcerated, and was followed by the same consequences, and, conjointly, they soon destroyed him.

A gentleman, of a stout make, and about forty years of age, had a tumour, supposed to be sarcomatous, which had formed beneath the integuments on the lower edge of the pectoral muscle. It was attended with severe pain occasionally, at which time it rapidly increased in size, and produced a great deal of fever and irritation,* which made him look very sickly, and grow very thin, and caused some persons to deem the disease cancerous.

When the tumour had acquired a magnitude of about four inches in length, and three in breadth and depth, he

* Circumstances like these should, I think, be particularly attended to in the history of tumours; for they may serve, perhaps, to characterize the disease in which they occur. Tumours of an innocent nature commonly increase in an equal ratio, and do not excite irritation in the contiguous parts, or in the constitution. Yet this, as a general rule, has exceptions Some of these have been stated under the head of pancreatic sarcoma, occurring in or about the mammary gland.

submitted to its removal; the integuments were divided and turned back, and the tumour dissected off the surface, and, in some degree, from under the edge of the pectoral muscle.

When the tumour was examined, it was found to be composed of a steatomatous substance, contained in a thin capsule. This substance resembled that which I have described as being sometimes found in cells in the testis, or intermixed with the diseased organization of that part. It was firm, and resembled cheese in its yellow colour and unctuous appearance; but it was not unctuous to the touch.

The wound, made in the operation, soon healed, and the patient's health was restored to as good, or seemingly a better state than before the formation of this disease. He also regained his usual athletic form. But in less than three months after his recovery, two new tumours formed, one above, and the other below the cicatrix of the wound. The patient did not particularly attend to them till they had attained a size equal to that of a large walnut. To dissect out both these tumours, and make so free a removal of parts as to render it probable that no new growth would ensue, seemed to be a very formidable operation; and, as the nature of the former tumour was known, and it was supposed that these were of the same kind, it was agreed to puncture the upper one, to express the contents, and await the event. This was done by a puncture of half an inch in length, made by an abscess lancet. The contents were exactly like those of the original tumour. Vehement erysipelatous or irritative inflammation took place, and sloughing about the diseased part; the inflammation rapidly extended to the opposite side of the thorax, and then down the integuments of the abdomen to the groin. The

derangement of the constitution was as violent as the local disease, and in about a week the patient died.

These cases are related to show the danger of irritating wens, either of an irritable nature, or occurring in irritable habits; and because I have not met with such cases described in books in a manner adequate to the importance of the subject.

It deserves to be noticed in this brief account of encysted tumours, that the disposition to form wens prevails frequently in many parts of the body at the same time. It is not very uncommon to see many, even twenty or thirty wens, alike in their structure and contents, in various parts of the same subject. Nay, the disposition seems sometimes to be hereditary, and transmitted from parents to their children.

The subject would appear to me to be incomplete were I not to notice the formation of cavities, containing different substances, and which can neither be accounted encysted tumours, nor abscesses. The cysts are like the cysts of abscesses; they are secreting surfaces, not regular in shape, but varying according to the form of the parts, amongst which they are produced. They adhere, also, like the sides of abscesses, to the circumjacent parts, and are not easily separable from them like the cyst of wens. These cysts sometimes contain a kind of serum and hydatids like the cysts formed in the liver, and other viscera. Sometimes they contain a number of granular substances of a white colour, having a polished surface, and generally an oval figure, which resemble pearl barley, but the granules are generally smaller. I have seen the cysts containing

hydatids, in the back and about the hip, on the shoulder and in front of the elbow joint.* I never met with any

* The cysts from which such substances are discharged, are, in general, very irritable. If they are kept open for some time, an alteration seems to take place in the actions of the part, and they no longer continue to secrete that matter which forms the granules I have described, nor the fluid in which hydatids are found. As these diseases are not so frequent as to be familiarly known to surgeons, whose practice is not extensive, I will relate two cases to show the nature and treatment of such diseases.—CASE. A young lady had a considerable collection of fluid beneath the biceps muscle of the arm. It protruded on either side of the muscle, and reached to about three inches above the elbow joint. I punctured it with an abscess lancet, and discharged about six ounces of serous fluid, containing a few hydatids. The wound, which was an inch in length, was dressed with spermaceti salve, a bread and water poultice applied, and the arm was supported by a sling. For a few days serous fluid oozed from the aperture, when the external wound had closed so much as to prevent its escape. I introduced a probe into the cavity, and afterwards a small tent, to prevent the aperture in the cyst from closing. This trivial irritation caused great disturbance in the parts, to a considerable distance, which became heated and swollen, and so painful, that I dared not to persevere. The wound was suffered to heal, which it soon did; but the fluid collected again. Instructed by this experience, I now opened the cyst with a lancet, introduced a probe-pointed bistoury, and enlarged the aperture to the extent of an inch and a half. This wound was dressed superficially; it was three weeks before it closed, and afterwards no collection of fluid took place in the cyst, and the patient remained perfectly well.—CASE. A gentleman had for many years suffered great inconvenience from a collection of fluid beneath the fascia of the ring finger, the palmar fascia, and that of the fore-arm. The collection seemed to have begun in the palm of the hand, but had extended itself half way up the theca of the ring finger, and passing under the carpal ligament, had made its way by the ulnar side of the flexor muscles, and protruded the fascia of the fore-arm in that part which intervenes between the flexors of the fingers and the flexor carpi ulnaris. At this part the fluid was nearest to the surface, and it was agreed, in consultation, that it should here be opened. I accordingly made a division of the skin about two inches in length, to expose the fascia of the fore-arm, which I divided to the extent of an inch and a half. I then distracted the muscles a little, when there

containing these granular bodies but about the hip, and, in the thecæ of tendons; I have, therefore, conjectured that these cysts are enlargements of the bursæ mucosæ.

The greater number of these cases, which I have seen, have ultimately, but very slowly, done well. However, some cysts, upon becoming open, produce great and even fatal irritation in the contiguous parts. Sometimes cysts, as Mr. Hey has lately remarked, produce that appearance which he has called fungus hæmatodes. Of this circumstance, as it appertains to the present subject, I shall relate an instance; but to speak more largely of that disease, would be deviating from the plan of this paper, and would be unnecessary, as the numerous and accurate cases which Mr. Hey has related, show that this disease may exist without being connected with cysts.

gushed out a large quantity of fluid, containing a number of the largest granules that ever I had seen formed in the sheaths of tendons. Several of them were as big as small grapes. By pressing the palm of the hand more were forced out, yet I remained uncertain whether the whole were discharged. The wound was dressed superficially with spermaceti salve, a bread and water poultice applied, and the arm kept supported in a sling. Three days after the operation, fearing lest some of the granules might remain, I introduced the point of a varnished catheter, and impelled some warm water beneath the fascia of the hand. No granules returned with it: but this experiment caused great nervous irritation in the part, and in the constitution in general. Nothing, therefore, was farther done that could irritate the parts, and the wound healed in about six weeks, in the following manner: The skin on either side of the wound became tumid, and threw forth exuberant granulations to such a height, that a swelling as big as half an egg cut lengthwise, projected above the level of the skin; as the granulations from either side touched, they coalesced, and thus the divided fascia was covered. The granulations being afterwards absorbed, the cicatrix appeared like one from a common cut, and the integuments were flat, and in a natural state. I saw the patient two years after this operation, and there had been no new collection of fluid.

A girl about sixteen years of age, who was in St. Bartholomew's Hospital, had a collection of fluid under the triceps extensor cubiti, near to the olecranon. When I first saw it, it was not larger than a pullet's egg, but it increased, notwithstanding the means which were employed to discuss it; and in about twelve months, it presented itself beneath the integuments on the outside of the arm, in the space between the extensor and flexor muscles, a little above the elbow. Upon compressing the projecting integuments, a fluctuation of fluid was felt beneath the triceps muscle in the inside of the arm, and the collection seemed to extend high up on the back part of the os brachii. As the parts containing the fluids seemed more disposed to increase in dimensions, than to give way and discharge their contents, the collection was opened where it pointed, and a quantity of serum was discharged. On introducing the finger, some strata of coagulated blood came away, and this was succeeded by so great an hæmorrhage, that it became necessary to enlarge the wound, in order to search for the bleeding vessels. In proportion as this was done, and more coagulated blood was detached from the sides of the cyst, which had contained both it and the serum, the hæmorrhage increased, and the blood flowed so profusely from so many and such large arteries, that it was impossible to controul its effusion. Amputation seemed unavoidable, and was performed as high up as possible, but not clearly above the cyst,' some part of which remained amongst the muscles of the stump.

On examining the amputated limb, a thick and firm stratum of coagulated blood was found adhering to the sides of a cyst, which extended from a little above the olecranon, where it was large, to nearly the upper part of the os bra-

chii, where it gradually tapered to a small size. The upper part of the cyst was cut off from the rest by the amputating knife, and of course remained upon the stump. At first the stump appeared to do well, but shortly after the sides of the wound separated, considerable inflammation came on, and a fungus was thrust forth. Great fever and irritation accompanied this local disorder, and the girl died.*

The treatment of encysted tumours resembles that of the sarcomatous kind. By abstracting blood and heat from the part it is probable the growth of them will be stopped, and the disease made for a time stationary. They are not likely to be dispersed; and as the magnitude is increased by delay, and the spontaneous opening of the cyst generally leaves a vexatious and intractable sore, and sometimes is attended with more dangerous consequences, the early removal of the disease is the best practical conduct that can be pursued.

* An unrestrainable hæmorrhagic tendency seems to be the essential character of that disease, which Mr. Hey has denominated Hæmatodes. That it takes place from diseased structures is manifest; yet I have known it happen without any morbid growth having preceded it. I shall briefly relate a case of this description, because the term fungus hæmatodes seems to be a name commonly now applied to every bleeding fungus, whilst that hæmatodal disposition, which Mr. Hey has described, is a very rare occurrence.—Case. A young man, who was out of health, complained of stiffness and pain in the bottom of his belly, and took to his bed, declaring his inability to move about. Suddenly a swelling formed above the Poupart's ligament, which rapidly increased, and the skin ulcerated. A frightful fungus seemed to present itself, and an uncontroulable hæmorrhage ensued. When the case was examined after death, all that bulged out could be removed by the finger or sponge, and appeared to be coagulated blood, rather than fungus, and at the bottom nothing was seen but the abdominal muscles, which had that bruised and brownish appearance which Mr. Hey has described.

Another genus of tumours is the osseous. Those which hang pendulous into joints are sometimes bony. Osseous tumours also form, though not frequently, in other parts: of this circumstance I shall relate the following instance. A woman was admitted into St. Bartholomew's Hospital, with a hard tumour in the ham. It was about four inches in length, and three in breadth. She had also a tumour on the front of the thigh a little above the patella, of less size and hardness. The tumour in the ham, by its pressure on the nerves and vessels, had greatly benumbed the sensibility, and obstructed the circulation of the leg, so that it was very œdematous. As it appeared impossible to remove this tumour, and, as its origin and connections were unknown, amputation was resolved on. On examining the amputated limb, the tumour in the ham could only be divided by a saw; several slices were taken out of it by this means, and appeared to consist of coagulable and vascular substance, in the interstices of which a great deal of bony matter was deposited. The remainder of the tumour was macerated, and dried, and it appears to be formed of an irregular and compact deposition of the earth of bone. The tumour on the front of the thigh was of the same nature with that in the ham; but containing so little lime, that it could be cut with a knife. The thigh-bone was not at all diseased; which is mentioned, because, when bony matter is deposited in a limb, it generally arises from a disease of the bone. This case, however, shows that the vessels of a tumour may secrete phosphate of lime, and convert it into an osseous substance, without any manifest cause existing to excite such ossific inflammation.

Vascular tumours, also, may doubtless become converted into a substance resembling cartilage, like those

found in joints; and their hardness might then exclude them from the genus sarcoma. I have not, however, met with such instances.

The diseases which I have been describing may be considered as edifices which are built up by diseased actions, and in which those diseased actions continue to reside. The actions themselves do not admit of examination, though the structures do which they erect. Therefore, as Dr. Baillie has observed, it is by an examination of diseased structure that we must be slowly led to a knowledge of diseased actions. It does not follow as a certain consequence, that similar diseased actions will, in every instance, produce precisely the same diseased structure; though it is highly probable that they will do so in general. This observation would diminish our surprize if, in some rare instances, we found cancer existing where a cancerous structure was not strikingly manifest; or if, in others, a structure like that of cancer was observed where no cancerous actions were apparent. The scirrhous tumours, which form beneath the peritoneal covering or lining of the uterus, have something of the structure of cancer, and yet they are not cancerous. In all cases where tumours are formed we must suppose an increase, and, in some degree, a disordered action of the vessels which form them; but in many these actions possess but little diseased peculiarity. As in every case of growth, in the re-production of destroyed parts, the gelatinous substance of the blood is first deposited, and afterwards rendered vascular, therefore I have considered a tumour formed in this manner as one of the most simple kind, and possessing the least of diseased peculiarity; but I am aware that I may have included under this general character tumours of essentially different natures. In the

adipose sarcoma there must be some peculiarity in the arrangement and actions of vessels which form this tumour; but it must be accounted a natural rather than a morbid peculiarity. The pancreatic sarcoma, I should suppose, differed but little from the first species. It may be considered as a new growth characterized merely by the peculiarity of its appearance, in consequence of its being separated into many distinct parts which sometimes cohere by a looser kind of texture, and sometimes are separated by a firmer substance. The connecting medium appears like the thickened cellular substance of the part in which the newly organized matter is formed. Indeed I have sometimes pressed out the separated portions of this substance from the connecting medium which environed them. In the mammary sarcoma I suspect some diseased peculiarity to exist, as has been mentioned in speaking of that subject. In the tuberculated sarcoma the predisposition to that disease seems general on the part of the constitution. In the medullary sarcoma the disease seems local, in the first instance, and propagated by means of the absorbing vessels to their glands, and frequently in a course retrogade to that which the absorbed fluids would naturally take; but in the advanced state of the disease the morbid disposition appears to be general. In carcinomatous sarcoma the disease appears to begin in a point or small district, and to extend in every direction, as rays do from a centre, affecting every surrounding part, whatever may be its nature. The diseased actions, also, though they may be at times more violent or more tranquil, never cease. This disease is also extended through the medium of the absorbing vessels in the direction which the absorbed matter would naturally take.

ON CHRONIC AND LUMBAR ABSCESSES.

Chronic abscesses differ from those produced by phlegmonoid inflammation in many particulars. In diseases of an active and violent nature, the contiguous parts become affected, whilst in those of an indolent disposition they remain free from disease, and unaltered in structure. An absorbent gland, for instance, may be enlarged to a considerable size; yet, if the disease be of an indolent nature, the surrounding cellular substance is loose and pliant. On the contrary, if one or two of these glands undergo active inflammation, the surrounding parts participate in the affection, and all traces of the glands primarily affected, are lost in the more general inflammation and abscess. In phlegmonous abscesses, the inflammation which was most violent in the centre, and had there terminated in suppuration, had, at the same time, induced adhesion of the surrounding cellular substance; and thus the sides of the abscess are, as it were, walled in and supported; and the extension of the disease in the circumference is to a certain degree prevented. It also appears, that it is very much owing to the parts covering the front of the abscess participating in the irritation, that the matter so readily makes its way to the surface, and is discharged.

On the contrary, in chronic abscesses it generally happens, that very little adhesion of the surrounding substance takes place, and the matter is more at liberty to extend

itself in all directions; at the same time, the parts covering it do not participate in the disease, they therefore do not inflame and ulcerate till their distension induces them to do so, and such a degree of distension may not take place till the abscess has acquired an enormous magnitude.

Now, if it could be proved, and I think it practicable, that chronic abscesses are not from their nature deleterious diseases, but are disturbing and destructive to the constitution in proportion to their magnitude, we should then clearly see, that the objects of surgery in their treatment ought to be those of preventing their increase, or reducing their dimensions.

As inflammation varies in its degree, so there are many abscesses neither strictly speaking phlegmonous nor chronic, but of an intermediate nature. I think, therefore, it may be useful to insert a case of purely chronic abscess, as an illustration of the preceding remarks.

CASE I.

An abscess containing twelve ounces of well-formed pus took place beneath the integuments covering the upper part of the pectoral muscle; it elevated the skin, and had formed a globular kind of tumour. This suppuration had been attended with scarcely any pain, and the integuments, although distended, were indolent, and appeared perfectly healthy and natural. I punctured the abscess with a lancet conveyed obliquely between the integuments and the cyst, evacuated the contained pus, and closed the aperture with sticking plaster: but on the re-accumulation of matter it was no longer confined in a cyst, but became diffused

through the cellular substance leading to the axilla, in which a slight inflammation was produced. I was, therefore, obliged to make a new orifice, and leave it open, that the secreted matter might have an outlet, and not extend disease, by thus pervading the cellular substance.

The surface of the cysts of all abscesses has the power of secreting and absorbing their contents. Even phlegmonous abscesses occasionally disperse, and many cases are on record of large abscesses, which I conclude were of a chronic nature, being dispersed in consequence of the occurrence of a diarrhœa. It appears to me, that the cysts of abscesses perform the same function with respect to their contents that the membranous surfaces of cavities do in cases of dropsy. In either instance, if secretion exceeds absorption, the disease enlarges; if it be equal, the disease is stationary; and if it be less, the disease diminishes.

With this view of the subject, and knowing the danger arising from the opening of chronic abscesses, I have endeavoured to disperse them, and I have sometimes been successful in my attempts. As an instance of what may be accomplished, I relate the following case:

CASE II.

A gentleman about twenty-six years of age, consulted me on account of a very large abscess which had formed amidst the muscles of his thigh. It protruded the fascia on the front of the vastus internus muscle, from the patella to above the middle of the thigh: the posterior muscles of the thigh also bulged outwards, so as to give a considerable

convexity to the back part of the limb. The patient looked unhealthy; he was languid and irritable; he had a furred tongue; the actions of his bowels were irregular, and the secretion of the bile was deficient or faulty. I desired him to drink a pint of the decoction of sarsaparilla daily; to take five grains of the pil. hydrarg. every second night, and to pay strict attention to keep his bowels regular. I also recommended a bandage to give support to the sides of the abscess. However, it continued to increase, and in about six weeks the integuments at the lower part became more prominent than elsewhere, and felt heated and uneasy. Fearful of their becoming inflamed, and frustrating the plan of treatment which I designed to pursue, I opened the abscess with an abscess lancet, making a wound about three-fourths of an inch in length. About thirty ounces of serous pus flowed through this orifice, but the current was very frequently obstructed by large clots of that flakey substance which is so commonly found in such abscesses. Towards the end of the discharge clots of blood obstructed the orifices, and they were so numerous and large, and came out of the aperture with so much difficulty, that I thought it better to close the wound, even before the abscess was completely emptied, than run the risk of irritating the sides of the wound by too much poking, or of admitting air into the cavity of the abscess. I therefore cleaned and closed the sides of the wound by sticking plasters and applied a roller round the limb. The wound healed, and the patient's health was in some degree improved. At first the cavity of the abscess filled rapidly, so that the fascia protruded again. The protrusion, however, did not increase, and the disease seemed stationary. After about three weeks the patient was permitted to take exercise on account of his health, and he generally slept in the

country. By these means, and with the continuance of his medicines, his appetite became good, and his bowels regular. He then left off the sarsaparilla, and took the pil. hydrarg. only, when he observed that the fæces were not of a proper colour. As the patient's health amended, the abscess decreased, so that in about six months there remained no evidence of such a disease having existed. After some time, the patient went into the army, where fatigue and irregularity of diet made him ill again, and he perceived some fluid in the abscess. He therefore relinquished this mode of life. On the restoration of his health, to which the use of the same medical means seemed to be contributary, no vestiges of the abscess remained; and though many years have now elapsed, no return of the local disease has taken place.

As chronic abscesses in general form in consequence of a disordered state of the constitution; and as it is subject to great disturbance when they become open, so it is requisite to endeavour to improve the general state of health prior to that event. By such means I have seen several chronic abscesses dispersed; and even if our endeavours have only the effect of rendering the abscess stationary, whilst the patient's health is improving, it is productive of great good, since it enables the constitution to encounter that disorder attendant on the abscess becoming open. Such topical applications as will afterwards be mentioned, may be employed at the same time, with a view to render the abscess stationary, or to diminish it, by lessening the secretion into the cavity, and by promoting absorption from it. I may also add, that I have seen several abscesses, which continued to enlarge under such management in the first instance, dispersed by it, after they had been once punctured.

The foregoing remarks and cases are designed to illustrate the nature of chronic abscesses in general, and I now proceed to consider the most important species of such a disease that we meet with in practice, I mean the lumbar abscess. Some lumbar abscesses can, indeed, scarcely be denominated chronic; they are formed with so much pain, the pus which they contain being good, and so unlike what is generally found in the cysts of indolent abscesses, that we must suppose the disease which produced it was of a different nature. I have seen also inflammatory fever induced when such an abscess has become open, which was an additional proof of its being of a phlegmonoid nature. Such occurrences are, indeed, very rare: but it very commonly happens that the formation of lumbar abscesses is attended with more pain, and other inflammatory symptoms, than are incident to chronic abscess in general.

Whatever the nature of a lumbar abscess may be, the surgical treatment of it must be similar to that of a chronic abscess; for as the matter presents in a part of the body which is so remote from that where it was originally formed, as not to sympathize with the disease; so the progress of the abscess, before breaking, will resemble that of a chronic abscess. To use the language of Mr. Hunter, a lumbar abscess, where it presents, is to be considered as an abscess in the part, and not as an abscess of the part.

As lumbar abscesses in general descend along the psoas muscle, under Poupart's ligament, and present beneath the fascia of the thigh, the resistance of the fascia affords an additional obstacle to the progress of the matter to the surface, so that such abscesses, if left to themselves, often acquire an enormous magnitude before they spontaneously open.

Lumbar abscesses also, in general are not simple diseases; they arise from and communicate with carious vertebræ; which circumstance is, I believe, the cause of their frequent fatality. The first eight cases that I attended, after I had adopted a new mode of opening them, were simple abscesses, and not arising from disease of the bone; which led me to believe, that they were more frequently unconnected with diseased bone than later experience has taught me. The general opinion of surgeons, in which I entirely concur, is, that lumbar abscesses most frequently arise in consequence of diseases of the vertebræ, and they should certainly all be treated as if such was their origin.

Before I proceed to describe the particular treatment which I would recommend in chronic and lumbar abscesses, it will be useful to enquire into the cause of that constitutional disorder, which is so generally consequent to their becoming open. It has been ascribed to the admission of air into the cavity of the abscess, or to the absorption of pus from it. That it is not owing to the former, we infer, because air does not appear to be stimulating to those surfaces of the animal body, to which it is not naturally applied. The air which escapes from a wounded lung, and renders the cellular substance emphysematous, produces no inflammation of it. Air has also been blown into different cavities of the body, to ascertain its effects; and it has been absorbed from them without having excited any inflammation. Neither does air appear to be stimulating to the exposed surfaces of ulcers which are in a state of disease. Yet, though air seems to have no stimulating property to such surfaces, and, therefore, cannot be assigned as the cause of that irritation and inflammation consequent

to the opening of an abscess, yet it is of the highest importance in pursuing the treatment which I have recommended in these abscesses, that no bubble of air should be admitted into the cavity, because it would probably cause the putrefraction of the fluid contained in the abscess, the absorption of which would be very deleterious. To show the consequences that might arise from such an occurrence, and to urge the necessity of all that caution which I shall recommend in opening lumbar abscesses, I relate the following case:

CASE III.

A surgeon discharged a large quantity of pus, containing flakes, from a lumbar abscess, which presented itself beneath the fascia of the thigh. The matter was discharged through a wound made by an abscess lancet, and in holding open the orifice with probes, in order to give discharge to some coagula, a bubble or two of air was admitted into the cavity of the abscess. His assistant perceived this occurrence, and mentioned it to me prior to the coming on of those symptoms which afterwards took place. When the abscess was emptied, the wound was closed with sticking plaster, and bound down by many straps of plaster placed over it. On the third day the patient was attacked by so violent a putrid fever, that it could be compared to no other, unless to such as is occasioned by the plague. The fascia of the thigh was elevated as much as it had been before the operation; the skin was very hot, and of a dusky colour. On removing the straps and coverings from off the wounded part, a large blast of fœtid air burst from the aperture, which was followed by the discharge of a considerable quantity of a very offensive and bloody fluid. The

patient lived but twenty hours; and, on examining his body afterwards, a considerable quantity of bloody fluid was found effused into all the large cavities.

If the notions which have been delivered respecting abscesses be correct, I mean, that there is continual secretion, and continual absorption from the cyst, as from a membranous surface, or from that of an ulcer, then it would follow, that the absorption of pus cannot be productive of fever. Though absorption of pus is continually taking place, yet no fever occurs before the opening of an abscess; neither does it come on where abscesses are dispersed, and where such absorption must indisputably have happened. It is true, in these cases, the pus is generally inoffensive in its qualities; it might be contended, that though it be admitted into the circulation with impunity, yet some of the fœtid matter usually discharged from the surfaces of open abscesses, being absorbed from them, might prove the cause of the fever. We do not, however, find such fever produced by the absorption of fœtid matter from the surfaces of large ulcers. We frequently apply the term "putrid" to substances merely fœtid, as well as to those in a state of chemical putrefaction; and from this inaccuracy of language, I suspect the equal inaccuracy of opinion has arisen, which has led to the belief of deleterious consequences succeeding to the absorption of matter. I need not discuss these subjects further, because the enquiry into the true cause of the fever will furnish arguments to refute false notions.

An attentive examination of the subject will, I believe, convince us, that the fever depends upon the state of irritation and inflammation which takes place in the cyst of the abscess. First, because its violence corresponds with

the degree of local inflammation. Thus, in the old method of opening chronic abscesses by an incision of considerable length, the fever was much more violent than when the abscesses were suffered to break of themselves, or when they are merely punctured. Secondly, because the kind and degree of fever accords with the state of inflammation and irritation existing in the cyst of the abscess. Thirdly, when a lumbar abscess opens spontaneously, in a manner productive of the least possible irritation to the cyst, the patient sometimes remains for many days without heat or pain in the part, and without fever. Afterwards, when the cyst has become irritated and inflamed, and the constitution disturbed by a peculiar kind of fever, the symptoms may, and generally do subside, and the patient merely feels languid, and slightly hectical. If local irritation is again excited, again the concomitant fever takes place. The cases which I shall afterwards relate will, I think, prove these assertions; and they have induced me to believe, that the disturbance of the constitution at large depends upon, and accords with, the local disease. Such opinions lead to this practical conclusion, that if we wish to prevent or mitigate the fever, which exhausts the patient's powers, we should do every thing to prevent and allay the local disorder, which is likely to arise in the abscess.

There seems nothing mysterious or difficult to account for in the effects resulting from an abscess becoming open. If any of the natural cavities of the body were in the same state, inflammation would ensue, and would produce a fever corresponding to it in its nature and degree. From the weak and peculiar state of constitution, subject to chronic abscess, both the local inflammation and the concomitant fever are in general of a peculiar kind: the local inflamma-

tion partakes of what would, in general, be denominated an erysipelatous nature, and the fever of a violent and rapid hectic. I have, however, known the opening of a lumbar abscess productive of inflammation of a phlegmonoid character in the cyst, and then the constitutional affection was likewise what we term inflammatory fever.

Having thus endeavoured to investigate the cause of the evils resulting from a chronic abscess becoming open, I may further add, that if the opinions which I have formed of them be correct, the danger must greatly depend upon the dimensions of the abscess. A chronic abscess, beneath the fascia of the thigh, may be opened, when it contains four ounces of pus; and if the surface becomes irritated and inflamed, it may induce a degree of constitutional disturbance and fever; yet such an abscess neglected, may increase till it holds four quarts;* and then, if it becomes open, and has the same degree of local disease, and it were granted that it should only act upon the constitution in the same proportion, it must produce more than thirty times the degree of fever. If, also, we are to ascribe the weakness consequent to the opening of chronic abscesses in any degree to the drain of fluids which takes place from them, it will be in the same proportion greater in the latter than in the former case. It seems, however, probable, that it is the violent actions which exhaust the patient's strength, and not the loss of fluids; for in dropsies of the ovary, a much greater loss of more nutritive fluids is not attended with weakness in any material degree.

After this discussion of the nature and cause of the ill

* I have discharged four ale-house quarts full of matter from beneath the fascia of the thigh.

consequences resulting from the opening of chronic abscesses, we may proceed to establish rules for their treatment. The first object, I think, is to disperse, if possible, lumbar abscesses, because it is most probable that the matter is in contact with diseased bones; and that the inflammation consequent to the abscess becoming open, will be communicated to those parts.

With this view an issue should be made in the loins, which is likely to be beneficial by its counter irritation, even when the abscess is not connected with diseased bone; but when it is, then an issue will be still more serviceable and necessary. The patient also should be kept in bed till all inflammatory tendency, which will be indicated by the increase of the abscess, has ceased. Then exercise in the open air may be permitted, on account of its beneficial operation on the constitution of the patient.* It should, indeed, be our unremitting object throughout to invigorate and tranquillize the constitution; and the means which I should employ for this purpose, are those which tend to preserve the digestive organs in, or restore them to, a state of health. If the abscess becomes open notwithstanding all our endeavours to the contrary, these measures will enable the constitution to bear up against the disease; and as such local diseases are the consequence of a weakened and disordered state of body, they may, by relieving the cause, remove at the same time the effects, as has been shown in the second case.

That lumbar abscesses may be dispersed by these measures, will be proved by the cases which I shall afterwards

* Probably it would be best to exercise with crutches, as the lumbar muscles on the affected side would then be exempt from action

gelate: that we shall often fail in our endeavours to disperse them, is, indeed, highly probable in reason, and equally proved by occurrences in practice.

Let us then suppose that a lumbar abscess treated in this manner continues to increase; that it protrudes the integuments; that they, from distension, become irritated; that their temperature is slightly augmented; what are we then to do? Are we to wait till evident signs of inflammation appear? I think not. I would then relieve them from distension, by emptying the abscess through a wound made by an abscess lancet. I would open the abscess for a reason which appears paradoxical on its first proposal; which is, that it may be kept closed. We can empty a cavity, and by healing the wound, keep it afterwards shut, and no inflammation ensues. If nature opens the cavity by ulceration, the opening is permanent, and the inflammation consequent must be endured. When I first treated abscesses in this manner, I punctured them with a trochar. I now use an abscess lancet; which is introduced with very little obliquity, so far that the wound of the cyst of the abscess should be half an inch in length, and that of the integuments of course a little longer. A wound of that size is generally sufficient to give discharge to the solid flakes which will occasionally block up the opening, without much poking. It is necessay that the flow of matter should be uninterrupted, so that no air should gain admittance; it is, therefore, right to make pressure on the abscess in proportion as it is emptied. The abscess where it presents itself is emptied before that part of it in the loins is completely so. The surgeon should then press the sides of the wound together with his finger and thumb, so as to prevent the ingress of air, and desire the patient to

cough repeatedly, which will impel the matter from the internal part of the abscess into that which is punctured. When the abscess is emptied as much as possible, the wound should be attentively wiped, and the edges placed in exact contact, and retained in that state by strips of plaster. I interpose some lint between the plaster and the surface of the wound, closing it exactly as that made in venæsection. I think it useful to put a small compress over the part where the orifice is, and give it a slight degree of pressure by longer strips of plaster. It is of great consequence that the patient lie perfectly still, and that the plasters are not moved. I think it better not to put on a bandage, because then the patient may perceive whether the plasters are right or wrong. I dress the wound every second day. It generally unites by adhesion, though some times otherwise; for it may discharge a little, and yet unite firmly. An abscess, thus treated, is as free from inflammation as it was before it was punctured. The abscess will, however, fill again, and that sometimes even rapidly. In the first cases which I attended, I punctured it pretty regularly after the expiration of a fortnight, and I found in general that the abscess contained about one-third less of fluid. I have, indeed, been obliged to puncture the abscess at first before the end of the fortnight; because it had become distended, and I was fearful that the distention might cause the newly healed wound to inflame, or unclose itself. After having discharged the contents of the abscess three or four times, I found that it was not necessary, nor indeed easily practicable, to puncture it at the end of the fortnight, because it was so little filled and prominent. Since my attention has been more directed to the dispersion of abscesses, I have generally been able by such means as tend to lessen the action, and conseqent secrec-

tion of the cyst of the abscess, and also to promote absorption, to protract considerably the intervals of time at which it has seemed necessary to puncture the abscess, lest it should become distended. Nay, I have been able to disperse many lumbar abscesses after having punctured them twice or thrice, though I was incapable of preventing their increase prior to these measures.

The dispersion of lumbar abscesses is the grand object which a surgeon should have in view throughout the treatment of them. He should endeavour to disperse them, but by means which are at the same time calculated to increase the patient's strength. If, however, the abscess increases, and he is obliged to open it, in order to prevent its becoming open spontaneously, he should still pursue the same measures; for the necessity of his puncturing it again is thereby diminished, and he gains time, which he employs in endeavouring to invigorate the constitution, and diminish the disease of the bone, upon which, perhaps, the abscess depends. Suppose, however, he is unable to effect his chief design, that of dispersing the abscess; suppose, after having punctured it five or six times, at long intervals, one of the punctures inflames and ulcerates, it must, I think, be evident, that great good has been effected by the measures that have been pursued. After a lumbar abscess has been punctured, the fluids secreted into it will flow into that part where there is the least resistance, which is the part that has been punctured. The pressure of respiration will urge them from the original cavity into the now vacant space, where the abscess had presented itself. The original cavity being a long time thus kept empty, will contract into a small fistulous tube.

Those who are advocates for letting lumbar abscesses open themselves by ulceration, because it imparts less irritation to the cyst than a wound occasions, have in this case their wishes gratified; a much reduced lumbar abscess does, when treated in this manner, open by ulceration. If there be any truth in the reasoning which I have employed, showing that the constitutional disorder will be in proportion to the extent of the surface affected with disease, that surface is now comparatively small.

It must, however, be granted, that under these favourable circumstances, when the abscess leads to carious bones, the disease is generally, though not constantly, fatal. Instances have been known of pieces of mouldered vertebræ making their way through the fistulous remains of the abscess, and obtaining an external outlet; and yet the patient has recovered. As we cannot know whether the bone be diseased or not, and as these abscesses so generally arise from that cause, we should always act with a caution suggested by the opinion that they do so. When the abscess has become open by the ulceration of one of the punctures, which the surgeon has made in order to reduce its dimensions, or so to alter its state as to increase his chance of dispersing it, the patient must encounter the risk attendant on the disease; but the surgeon has still much to do. The ulcerated part should be dressed with mild salve; evaporating washes, or poultices, should be applied over it; in short, every means should be employed to prevent the cyst inflaming, in consequence of irritation imparted to it from the ulcerated puncture. Perfect quietude seems to be essential at this period of the case; for motion of the loins will induce or aggravate inflammation in the original diseased parts. Sometimes a considerable time elapses before

the cyst inflames; and when it does, opium should be given to quiet it. Sometimes the irritation and inflammation of the cyst subsides; and the abscess becoming indolent, the constitution is no longer disturbed, and the patient may be permitted to exercise for the benefit of his general health.

Before I proceed to the relation of the cases, from which the preceding views of the nature and treatment of lumbar abscesses were taken, I think it right to relate the case which first suggested to me that mode of opening these abscesses which I recommend; because it shows that an abscess of this kind, attended with even very favourable circumstances, may prove a fatal disease if mismanaged.

CASE IV.

A young man, about twenty-seven years of age, of a muscular form, and healthy constitution, came from the country to the hospital, to obtain relief from a collection of matter which presented itself in the upper and fore-part of the thigh, beneath the fascia, and immediately below Poupart's ligament. The pain which he had previously suffered in his loins, and the impulse of matter into the tumour upon his coughing, left little doubt of the original seat of the disease. The fascia of the thigh had yielded considerably to the collected pus; so that it did not descend so low as is common, but appeared very prominent. Although he had endured considerable pain, he had not suffered much from fever on the first formation of the abscess.

A caustic was applied on the tumour to give discharge to the matter, and three days afterwards the eschar was divid-

ed.—Eight ounces of very perfectly-formed, moderately consistent, and inodorous pus, issued from the incision.—The sides of the eschar now closed up the wound, and prevented any further evacuation of matter. This the surgeon did not attempt to produce, thinking the delay would be useful.

For three days no more fluid was evacuated, during which time the young man remained perfectly well, and his thigh free from inflammation.—On the fourth day, the eschar became so much loosened in its circumference that part of it gave way, and eight ounces more of similar and perfectly inodorous pus were discharged. In twelve hours after this detachment of the eschar, he suffered much from fever and pain in the part, and the discharge became putrid. In two days the fever, which was of the hectic kind, seemed to be established, and from the sore there flowed a copious and increasing quantity of fœtid pus. His skin was now hot, his face flushed, he sweated profusely in the night, his appetite failed him, his pulse beat 120 in a minute, his tongue was but little altered from its natural appearance, he had no sleep, and was distressingly restless. These symptoms continued about a week without cessation; they then appeared slightly to remit, and proceeded for three weeks in the same manner, with some little diminution in their severity; his strength was now greatly exhausted, the discharge from the abscess very profuse, and in this state it was thought right to have him conveyed into the country, where I am informed he gradually declined, and in about six weeks more he died.

Cases of Lumbar Abscesses dispersed without being opened.

CASE V.

I was desired to visit a young lady in the country, in order to open a lumbar abscess, which presented beneath the fascia of the thigh. It was not, however, sufficiently prominent to admit of the introduction of a lancet with safety, but there was a very forcible impulse of matter into it when the patient coughed. The patient was about fourteen years of age; her lumbar vertebræ were bent into more than a semicircle, and it is certain that a great number of the bodies of the vertebræ were destroyed by disease. The countenance was flushed, the pulse 120; the body emaciated, and the appetite lost. In short, it appeared to me, and the other medical attendants, that she was not likely to live. I explained to her father, that the opening of the abscess would be almost certain to destroy her; that if a necessity arose from its increase, it might be punctured at a future period, only in order to prevent its being permanently open. I endeavoured to explain to him the necessity of attempting to relieve the disease on which the abscess depended. With this view I recommended rest, and a horizontal position, except when exercise in a carriage was permitted for the benefit of her general health. A moderate-sized blister was also directed to be kept open, by means of the savine cerate on each side of the spine. Great attention was also paid to improve her health, by obviating errors in the functions of the digestive organs. The patient lived at a considerable distance from London, and I received, during about fifteen months, frequent letters from her father, containing little else than expressions of exultation and thanks. His daughter's appetite was im-

proved, and her strength increased; the hectic fever had left her; the abscess could no longer be perceived; she had become quite fat and robust, and had grown two inches in stature within the twelve months. After this time, the tone of his letters varied. He thought the discharge from the blisters might produce weakness; and, I believe, they were not continued for any considerable time, though I urged it as strongly as I could. The young lady, however, recovered, and had no return of the abscess.

CASE VI

A man, between thirty and forty years of age, came from the country to St. Bartholomew's Hospital, on account of a lumbar abscess, which had made its way outwards, and protruded the integuments of the back, on the left side of the lumbar vertebræ. The skin was very prominent, and the circumference of the abscess considerable. I think I do not exaggerate, when I say, that twelve ounces of pus were collected in the external abscess. The patient was feeble, and of a sickly aspect, and I thought that the bone was diseased. I desired him to remain in bed, and to keep open a moderate-sized blister on the left side of the loins; endeavouring, at the same time, to produce, by means of medicines, an amendment in his general health. In about two months there was no appearance of any external abscess. The patient was now desired to get up daily, and walk in the open air, but to lie on the bed when he returned. He remained in the Hospital pursuing these measures for two months longer; and though there was not the least appearance of the abscess during this period, I could not perceive much amendment in his general health or appearance. Indeed, as no good seemed to be done by his resi-

dence in the hospital, I advised him to return into the country, requesting him, at the same time, to inform me of the progress of his complaint or recovery ; but I never afterwards heard of him.

I was induced to put down this brief account of the preceding case at the time, from the surprize which it excited in my mind, as I had expected it to proceed in a very different manner. Later experience would prevent me from feeling surprize at such occurrences, for I have seen several lumbar abscesses dispersed by similar measures ; I mean, counter irritation, and endeavours to improve the patient's health. Though I could relate the circumstances from memory, and even refer to some of the subjects of them, yet the narrative would be little more than a repetition of the fact, and it might tend to induce students to expect such occurrences to be frequent ; whilst, on the contrary, I am ready to admit, that they probably will be rarely met with in general practice.

Cases of Lumbar Abscesses that have been dispersed after their Contents have been discharged.

CASE VII.

——— Harris, thirty-five years of age, had a considerable collection of matter beneath the integuments of the abdomen, forming a moderately prominent tumour, about three inches in diameter, and situated just above Poupart's ligament. The patient had suffered a great deal from pain in his loins ; and the motion of the thigh had been much

impeded but was now tolerably free. Indeed there was no doubt that the matter had been originally formed in the loins; from whence it was violently impelled, so as to elevate the prominent integuments of the abdomen, whenever he coughed. By permission of Mr. Long, under whose care he was admitted into the hospital, I punctured the tumour, and discharged about 24 ounces of pus, mixed with some flakes of a curd-like substance. The wound healed readily, and no considerable alteration of his health ensued, though he found himself weaker for some days after the operation. At the end of a fortnight, I made a second puncture, and let out between six and seven ounces of a turbid fluid. He now thought himself so much better than after the first evacuation, that he went out of the hospital; but returned again at the expiration of a fortnight, when, by a third puncture, six ounces of purulent matter were discharged; and, after another week, four ounces more were let out. A caustic was now applied to his loins, and four or five peas used to keep the ulcer open; from which time no matter could be discovered in the abscess during the six weeks that he remained in the hospital.

About eighteen months after this, he was admitted into the hospital on account of a fever and sore throat; and it appeared he had never experienced any farther complaint in his loins.

This case, I think, is very interesting, inasmuch as it contributes to prove that the cavity of a lumbar abscess may be entirely obliterated without the cyst undergoing any of those changes which generally take place when it is laid open.

CASE VIII.

Elizabeth Smyth, aged twenty-seven, had a lumbar abscess, which presented beneath the fascia of the thigh. The previous symptoms rendered the nature of the complaint indisputable; and as she not only showed evident marks of a scrofulous habit, but also felt considerable inability in moving the spine, there was great reason to suspect that the abscess originated from a disease in the bone. She was likewise troubled with cough, and drew in very little air when she inspired. Her appetite, too, was often deficient, and her bowels frequently disordered. It may also be added, that her brother, who greatly resembled her, was at this time a patient in the hospital, under Mr. Long, on account of a scrofulous disease of the spine, which had occasioned an affection of the medulla spinalis. When all the circumstances were taken into account, she certainly appeared a subject by no means capable of sustaining the irritation and disorder which the bursting of a lumbar abscess might be expected to produce. I therefore punctured the abscess immediately, and discharged from it twenty ounces of flaky matter; and having healed the wound, I gave her emetics of vitriolated zinc and copper, and afterwards of ipecacuanha, twice or three times a week, for six weeks. At the end of this time, there was so little matter in the abscess, that I thought it too small to be punctured with safety; and, as her health was too infirm to admit of the emetics being continued, I tried to produce absorption of the remaining matter, by passing the electric fluid through the abscess. Very small electric shocks* were according-

* These small shocks, which, for the sake of distinction, I shall call electric vibrations (a term, I believe, generally applied to them,) were made

ly sent from different parts by the side of the lumbar vertebræ, down to the groin, and upper part of the affected thigh; and, under this treatment, the contents of the abscess soon disappeared; nor did any further collection of matter take place during the time of her remaining in the house, which was nearly two months. The electricity also brought on the menstrual discharge, which for a long time had been very irregular; and her general health was greatly improved before she left the hospital.†

CASE IX.

Elizabeth Hart, about thirty years of age, had suffered greatly from pain in her loins, for ten months. During that time, matter had been formed, and made its way down beneath Poupart's ligament, in such quantity as considerably to distend the fascia of the thigh. She was much reduced in strength, and in the appearance of health, by this complaint; but as her constitution was good, and she could move the spine with facility, there was no reason to suspect any disease of the bone.

I punctured the abscess, and discharged two quarts of very healthy pus: and occasionally, after the orifice had

by discharging a small jar, the coated surface of which did not exceed fourteen square inches: and by placing the ball of the electrometer at a small distance from the conductor, generally about a quarter of an inch. One of the discharging rods was then moved about on the upper part of the thigh, and the other on the loins, so that the electric fluid might pass through the abscess.

† I have lately heard, that the abscess has not appeared again, though a year has since elapsed; but the pain in her loins has, (as might have been expected,) recurred.

closed, I ordered her emetics. She could not continue them regularly, however; as, during their use, her bowels became disordered, and she lost her appetite and strength. The accumulation of matter was, notwithstanding, evidently delayed by them; for when, at the end of three weeks, I next punctured the abscess, only one quart of serous fluid was evacuated. After the space of a month had elapsed, another quart was discharged. During this time she had taken emetics occasionally; but her health was far from good, and the pain in her loins was still considerable. I had now witnessed the beneficial effects of electricity in the case of the last patient, and resolved upon trying it here. It was accordingly employed three times a week, for three weeks. At first a small collection of fluid in the abscess was perceptible; but this was gradually absorbed; and by the end of the third week, there was no longer any pain in her loins, her health was greatly improved, and she was able to walk about, without the least appearance of her former complaint. She was, therefore, discharged from the house; but came once a week, for some time, to be electrified.*

The two last cases point out to notice a remedy that is likely to be of much advantage in the future treatment of lumbar abscesses. My experience of it, however, has not yet enabled me to determine how far it may be generally beneficial. In one instance where I employed it after the abscess had been once punctured, it kept the matter from collecting for a long time; but the patient growing tired of the confinement, and apprehensive lest the lancet should be again employed, left the hospital without my knowledge.

* This patient remains at present in perfect health: nor is there any reason to expect a relapse.

Of another, and somewhat analogous disease, in which it was tried, though not with complete success, I shall here relate the particulars; first remarking, that all the observations which I have made on electricity applied to diseased parts, lead me to conclude, that it acts as a stimulus, which has the peculiar effect of accelerating that process which happens to be going on at the time. Thus, in some states of inflammation, it hastens suppuration, whilst in others it promotes dispersion. We should therefore always endeavour, previous to the use of this remedy, to bring the tumour or abscess into that state in which its progress is stopped, and in which, perhaps, it is rather inclined to recede; and by this rule I have been guided in the application of this remedy to lumbar abscesses.

I have also been attentive to proportion the number and strength of the vibrations to the effect which they appeared to produce on the abscess: their operation seemed to be most beneficial when they occasioned a kind of irritation or slight uneasiness in the part for a short time after their application. But if this sensation amounted to pain, or if it was of too long continuance, I then suppose that the stimulus had been employed in too great a degree.

CASE X.

Israel Brooks, aged twenty-five, about two years ago, was first seized with violent pain in his loins, which prevented him from either riding or walking for some time. About three months afterwards, he had the rheumatism in the joint of one of his fingers, which shifted to his wrist, where it produced a thickening and disease of that part; and at present, all the carpal bones are evidently diseased, and

displaced. This disease also attacked his left knee, where it occasioned an enlargement of the joint, which still continues. Two months after this, he discovered a swelling beneath the glutæus muscle, which has gradually increased; and since that time the pain in his loins has become much less severe, but a sensation of great weakness remains. This abscess was shown to me at the hospital, as an instance of a remarkably large one; and there was no doubt but that it contained between two and three quarts of matter. There was also a prominence of the fascia on the front of the thigh below Poupart's ligament, accompanied with evident fluctuation. The several gentlemen, who examined this latter tumour, thought they could perceive an impulse given to it from within, whenever the patient coughed; whence it was supposed to have its rise from a lumbar abscess: but whether the abscess under the glutæus muscle communicated with the loins or not, we were unable to determine, as no such impulse could be felt in it.

I gave the patient emetics of vitriolated zinc and copper; and kept up an eruption of pimples on the skin covering the abscess, by rubbing it with a strong solution of tartarised antimony. Gentle electric vibrations were also daily passed from the loins through the front of the thigh, and also through the glutæal abscess. By this treatment, continued for two months, the tumour was very much reduced in size; that is, as far as could be judged of by the eye; for its situation prevented any accurate measurement of it. In spite of our endeavours, however, the patient's health had declined since his admission into the hospital; and in proportion as he lost strength, his other local complaints became worse. As it was now summer-time, and he had an opportunity of going to the sea. which had formerly been

of service to him, I punctured the glutæal abscess without loss of time, let out three pints of healthy pus, and then healed the opening. His weakness increased considerably after this discharge, and all his other complaints were much aggravated. The electricity was still persevered in; and at the end of three weeks, the quantity of matter in the abscess was very small; I cannot suppose it was more than eight ounces. I very much wished to have had an opportunity of making fresh punctures in this case; but the state of the patient's health obliged me, however reluctantly, to discharge him from the hospital.

I have always found that abscesses, evacuated in this manner, filled again to one half or two thirds of their original quantity in the space of a fortnight: so that here also, the beneficial effects of electricity are, in my opinion, sufficiently manifest.

Of late years, I have not, however, employed the measures pursued in the cases above recorded; but trusted altogether to such as seemed calculated to improve the health, by tranquillizing and invigorating the digestive organs. The result of such management has been, that, in general, the abscess has disappeared for a considerable time, after it has been two or three times punctured. After the lapse of some time, however, one of the punctures made for the discharge of the matter has unclosed, either with or without some trivial collection of fluid previously being formed in the cavity; and, I regret to add, that of late, in general, the disease thus circumstanced, has terminated fatally. Yet, I think, it will be admitted, that abscesses which open in this manner, open in a manner producing the least possible irritation to the constitution;

and that the previous treatment which they have undergone, has materially tended to diminish the risk commonly attendant on such diseases. I conclude, then, by relating one case of lumbar abscess, treated in the manner which seems to me best, which terminated fatally, as an example of what, I fear, will be the frequent termination of such cases. I will add, however, several cases, to show, that lumbar abscesses, when open, are not necessarily destructive diseases; and to suggest the treatment which ought to be pursued under such adverse circumstances.

Of Lumbar Abscesses becoming permanently open.

CASE XI.

James White, aged twenty-five years, came from Essex to be admitted into St. Bartholomew's Hospital, on account of a lumbar abscess. He had suffered much from pain of his loins for twelve months; and for some time past had experienced a difficulty in lifting up his right thigh. There was a curvature in the dorsal vertebræ; but that, he informed me, was an old complaint. Yet, from the general appearance of the man, from the difficulty he had in moving the upper part of the trunk upon the lumbar vertebræ, and from the caution with which he attempted this motion, I could not but suspect a disease of the spine. Issues were, therefore made in the loins; and on the 25th of June, I let out two quarts of purulent fluid from beneath the fascia of the thigh. He had less pain in the back after the operation: and though he was teased with a cough, his strength did not suffer any diminution. On July 7th, I discharged from the abscess fourteen ounces more, of a turbid brownish fluid. On the 17th, though the tumour in the thigh was inconsiderable, yet the part first punctured

was elevated and inflamed. It seemed that the puncture in the integuments had healed; while that in the fascia had not united firmly, but had suffered the matter to pass through it, so as to elevate the skin. To remedy this, which threatened to lay open the cavity of the abscess, I was obliged to puncture it in another place; and eight ounces of fluid were discharged. The patient was now in much better health than he had been for more than a year, and was able to lift up his thigh without pain. I therefore set him to exercise the muscles in the neighbourhood of the disease, thinking that if the exertion did not produce irritation, it might answer a good purpose. With this view, he stood upon the leg of the sound side, and alternately lifted up and let fall the other, until he was somewhat fatigued. By frequent repetition of this exercise, the muscles of the diseased side acquired considerable strength; and in a little time he felt himself (to use his own expression) "able to go to plough."

The fascia of the thigh was punctured every fortnight for some time, and afterwards every three weeks. When he had been nearly three months in the hospital, he became tired of the confinement; and, feeling himself strong, was very solicitous to have the abscess opened, and suffered to discharge itself. The disease of the spine made me unwilling to comply with his desire; and I sent him into the country for three weeks, that he might ascertain, by the journey, whether he was as strong as he supposed; thinking that if he bore it without fatigue, it might be of service to him. At the same time, I gave him strict injunctions not to exert himself, if his loins or thigh became painful; and, in that case, to return again by the first conveyance. It was five weeks, however, before he came back; when I

found that the abscess had inflamed, and burst, about twenty days after he left town; in consequence of which he became so ill, that he could not bear removal. He was now in a most wretched condition, being scarcely able to turn in bed, from the weak and painful state of his loins; his pulse was rapid, and his skin hot, and he had, occasionally, fits of chilliness, succeeded by sweating. He became considerably better, however, and continued so for some time, in consequence of the attention paid to him in the hospital; but his health again declined; and after several relapses, with intervals of temporary amendment, he, at last, sunk, and died at the end of three months from his re-admission.

On opening the body after death, I found that the abscess extended upwards to some diseased vertebræ. The diseased bone, however, did not immediately come into view on lifting up the peritonæum; for the tendinous expansion, which covers the bodies of the vertebræ, was still entire, and formed a kind of cyst distended with matter. When this was opened, it was found to contain pus, together with the fragments of three of the bodies of the lumbar vertebræ; there being ten or twelve detached pieces of bone lying upon the medulla spinalis, and surrounded with matter. This was evidently a peculiar disease of the spine, which neither caustics nor any other remedy could alter. It greatly resembled that diseased state which sometimes occurs in the carpus and tarsus, in which the small bones composing these parts are broken down, and lie confined in a ligamentous capsule, surrounded with matter. If the dead portions of the vertebræ had not been thus confined, they might have had some chance of removal; but under the circumstances already noticed, it is most probable that they would remain, and act as extraneous bodies, exciting irritation, and increasing the disease.

CASE XII.

July, 1790. John Tucker was admitted into St. Bartholomew's Hospital on account of a psoas abscess. His health had been declining for more than three years. He had for a considerable time been an out-patient, under the care of Dr. Austin, who had unavailingly endeavoured to prevent the formation of this abscess by issues made in his back, and by the administration of various medicines. He had suffered greatly from pain in his loins, and fever: the abscess was very large, and had descended very low on the inside of the thigh; the integuments covering it were natural; the impulse of matter into the tumour, upon coughing, very considerable.

His pulse was feeble, and beat eighty-six in a minute; previous illness had exhausted his constitution; he had a constant cough, and, undoubtedly, much diseased lungs.—He had little appetite, and was of a costive habit; he was of fair complexion, light hair, and blue eyes, and his countenance frequently flushed: he was, on all these accounts, as unfit a subject as can well be supposed to encounter the derangement of constitution which must succeed to the ordinary evacuation of the abscess.

On Wednesday, the 28th of July, I tapped the abscess with a small hydrocele trochar, and discharged three pints of pus of good quality, although in a small degree more fluid than common. I dressed the part with considerable caution. I moistened the lint which I applied to the orifice with tinctura benzoes composita, over this I applied some sticking-plaster, which was retained by cross slips, and afterwards varnished over with gum; some compresses of linen were applied over the abscess, and gently bound on by a flannel-roller.

On Thursday, there was no very perceptible difference in his health; he had slept and eat as usual, his tongue was moist and natural, his pulse a few strokes quicker.

On Friday, he said, that he found his loins relieved by the evacuation; that he could perceive no difference in his health, and his pulse was the same as before the operation. For many days his health remained unchanged; he became, he thought, a little weaker, and the frequency of his pulse had encreased about four strokes in a minute. For this little alteration we could readily account, knowing that some fluids were drained from the circulation into the cavity of the abscess, and that some little exertion of the system would necessarily ensue.—The abscess remained without pain, or inflammation, and his constitution free from fever; his skin continued in its natural state, his appetite was good, his sleep sound, and his countenance unaltered. Three days after the operation, I removed the dressings from the punctured part; it appeared healed; I, however, carefully removed the dressings every third day.

Friday, the 13th of August, sixteen days after the first discharge, the tumour having become prominent, I again punctured it, and evacuated its contents. I knew the discharge would increase his weakness; yet, if the collection were suffered to remain, it would shortly distend the cyst to its former dimensions, and my original plan of treatment would be frustrated.

The quantity of the discharged fluid was nine ounces; in appearance and chemical properties, it much resembled blood. This bloody effusion was probably the consequence of laxity of the exhaling vessels, as there had not been the least expression of inflammation in the abscess. Before I discharged the matter a second time, he complained of some pain in his loins; but the following day he said he was much relieved, and found himself remarkably well.

This second puncture was dressed like the former, and quickly healed.

During the time which had elapsed between the first and second discharge, he had not been confined even to the ward, but often went from the hospital to see his friends. This, his cough, the weak state of his health, his disinclination to live in the hospital, and the obvious impunity with which it was done, induced me to permit. After the second evacuation, he altogether lived with his friends, promising to come every week to let me see the state of his complaint; however, the second week, when the matter ought the third time to have been evacuated, he failed in his promise. I was now obliged to leave London for some time; so that I did not see the patient again until September the 8th, which was four weeks and five days from the former evacuation; he had refused to have the matter let out during my absence. I now discharged, in like manner, ten ounces of lymphatic exhalation, rather dark coloured and turbid, as if mixed with true pus. The man, during the last week, had complained of pain in his loins, and in his knee, both of which were relieved as usual by the operation.

Before the abscess was first opened, the impulse of matter from the loins, on coughing, was extremely forcible, but was now not at all perceptible. It appears to me, that a very considerable advantage is derived from this mode of treating these complaints. Whatever secretion is made in the abscess of the loins, will, by its gravity, descend into the space left by the seceded fascia of the thigh. The abscess of the loins being left perfectly free from distension, will most probably contract to very little dimensions, if it be not perfectly abolished. Hence, in the subsequent treatment of these complaints, you have only to attend to

the disunited fascia; whilst the cavity in the loins scarcely deserves notice.

September 22d, a fortnight after the former evacuation, I discharged four ounces of similar serous fluid mixed with pus. During its evacuation, which was very speedy, I had applied my fingers beneath Poupart's ligament, as if to obstruct the descent of any matter from the loins. I then desired the man to cough; but no matter descended, and the collection appeared to me entirely confined to the thigh.

I found some difficulty in introducing a trochar, when the abscess contained so little fluid. This was remedied by first introducing a lancet through the fascia, and then conveying the trochar through the aperture made by the lancet.

Thus, after discharging the matter four times, the complaint was reduced from a lumbar abscess containing three pints, to a small collection of matter beneath the fascia containing four ounces.—What communication this had with the loins, and what was the state of parts there, cannot be determined. To appearance there was no collection. If I had now immediately opened the abscess, the containing cyst being small, the inflammation probably would not have been considerable. But the state of the man's health induced me for a short time to defer this final attempt, this radical cure, as I may express it, and to be contented with only evacuating the matter when collected, without suffering the collection to increase the size of the cyst. It might be expected, by repeating the evacuation, that the cavity would diminish to its total abolition. This would probably happen, were the abscess in the cellular substance; but the inelastic fascia cannot contract, and the subjacent muscles cannot be elevated; so that the effused matter, though very small in quantity, would still keep them disunited.

I had let out four ounces of matter once in October; and on the 5th of November, I opened the abscess by an incision about an inch and a half in length at the lower part. I introduced my finger beneath the fascia, as high as Poupart's ligament; I desired the patient to cough, but no matter descended from the loins, neither could I ascertain any communication. The extent of the detached fascia was about four inches and a half in length, and nearly four in breadth. The cyst inflamed after opening. The hardness and quantity of the discharge increased for four days, and then gradually subsided. His thigh was stiff and sore, so that he could not easily move it, but he had no particular pain in his loins—his pulse did not vary—his tongue was not furred—his sleep was not interrupted—nor could any derangement of his health be perceived.

Granulations grew from the edge of the incision, and the opening nearly closed, and afforded scarcely any discharge. —Yet, on introducing a probe through the orifice, I found that the fascia remained disunited. With a view to produce an union, by exciting inflammation, I introduced a seton from this lower orifice to the upper part of the cyst. The fascia again inflamed, indurated, and united, only the track of the seton was unclosed; and this, by the injection of some spirit and water, was also soon induced to fill up. In discoursing with the patient, after opening the abscess, respecting his health, he said, he was ten times better than before it was opened; that until this time he had always been subject to fits of pain, and to a state of weakness and faintness which he could not describe.

After the perfect closure of the abscess, he could extend and bend his thigh with freedom and ease; he could also readily put his foot upon a chair set before him. This it would have been impossible for him to have done during the formation or continuance of the abscess. This freedom of

action in the psoas muscle indicated considerable soundness of it, and of the contiguous parts. He still, however, complained of much rheumatic pain in his hips, and sometimes in his loins; and as I supposed his constitution might be affected by the suppression of a long-continued purulent discharge, and might attempt, for its relief, the formation of a new abscess, I inserted two setons in the integuments of the loins, with a view of preventing inflammation of the internal parts.

They did not, however, relieve his pains; he complained much of their inconvenience, and as he designed to go into the country, they were discontinued. I saw him about a year afterwards—no alteration had taken place in the thigh, nor no fixed pain had attacked the loins, but he was still much teazed with unsettled rheumatic pains.

The preceding case was very unfavourable both from the patient's constitution and from the degree of the disease. Yet, by four times discharging the matter, which was not attended with much more pain than bleeding, it was reduced from a lumbar abscess, containing three pints, to a small collection beneath the fascia of the thigh, containing four ounces, and without any evident communication with the loins. Each time, instead of suffering inconvenience, he experienced relief; he had no fever, neither was he restrained from his usual occupations.

The final opening might have been sooner made, but as this was the first case in which I had pursued this practice, I was uncertain of the event, and irresolutely protracted it for two months, in expectation of amendment of his health. When it was opened no perceptible fever followed, and it shortly got well by the treatment which I have related.

CASE XIII.

Isaac Dean, thirty-seven years of age, had come from Hampshire to London, to obtain advice for a psoas abscess.

He was admitted into the hospital under the care of the late Mr. Pitts. The account which he gave of himself was, that his business had obliged him to be much on horseback; that he had formerly, when riding, bruised his left testis, which accident had occasioned an incurable disease of that gland; he therefore had suffered its removal about two years since in some county hospital. Since that time he had frequently suffered much pain in his loins; about eight months before his admission into the hospital he had caught cold; the pain in his loins then became more violent and constant, and much impeded the motions of his left thigh. About three months after this attack of severe pain, he perceived a tumour on the upper part of his thigh, which had gradually increased until the time of his admission into the hospital. Since the appearance of the tumour, the pain in the loins had much abated. The matter now descended about four inches beneath Poupart's ligament; and it received a forcible impulse when the man coughed. The fascia of the thigh at this part was very prominent, and the skin covering it was more red than the rest of the integuments.

The patient's health was not unfavourable; his pulse was rather strong, beating seventy-six in a minute, his tongue rather pale, his hair and eyes dark.

Monday, 3d of October, 1790, by Mr. Pitts' desire I introduced a trochar into the lower part of the tumour, and gave discharge to twenty-four ounces of pus, moderately tenacious, and containing some flakes of firmer matter: I cautiously closed the orifice, as in the former case, applied a compress, and bound it moderately tight with a roller.

I could not in this case perceive any alteration in the man's health deserving to be recorded, except that the pulse was a little quickened; he eat and slept as usual.

I carefully took off the sticking-plaster at the end of three

days, and renewed a similar dressing. On Thursday, 13th of October, the abscess was now again prominent, and the puncture made by the trochar seemed slightly inflamed. As I concluded the distention of the fascia caused this inflammation, and supposing that if the pressure of the matter from beneath was suffered to continue, it might occasion it to ulcerate, I determined to prevent this effect by again evacuating the matter. This I accomplished by passing a trochar into the lower part of the abscess, at some distance from the former opening; and by this means discharged between eight and nine ounces of pus, thinner and rather darker coloured than the former, but not tinged with blood as in the preceding case. I now carefully dressed both orifices, and again applied a bandage.

I cautiously removed the dressings, at the end of three days; the second puncture had healed, and the first had lost its disposition to inflame. After having dressed the punctured parts, and applied the bandage; I desired him to moisten it with aq. saturn. which I thought by keeping the skin cool, would prevent its disposition to inflame. The man suffered no alteration in his health from this second evacuation. On the 25th, at the end of a fortnight, the tumour being again prominent, I introduced a lancet into the fascia, and through the orifice thus made, the trochar, which discharged six ounces of turbid serous fluid, and I pursued the same subsequent mode of treatment.

After another fortnight had elapsed the tumour was much less prominent than before, and there appeared a degree of irritation in the skin. The punctures showed a disposition to inflame. I now desired the man to cough, but could discover no impulse of matter from the loins. This I had not before done, lest the exertion should affect the punctures, which were not so firmly healed as in the former case. As the patient had not suffered much from dis-

charge, as his health seemed fully capable of sustaining the effects arising from opening the abscess, as it was not probable that its dimensions could suffer further diminution by delay, on Friday the 23d of November, I opened the cavity by an incision of about an inch in length, at the lower part, and immediately passed a seton through to the upper part, with a view to insure the union of the fascia.

An unusual degree of inflammation of the fascia and stiffness of the affected limb followed, but he complained of no particular pain in his loins further than general stiffness.

The slight fever which accompanied seemed rather inflammatory than hectical, his pulse became a little quicker and harder, and his tongue slightly furred. These symptoms gradually abated, and at the expiration of three weeks the fascia appeared to have adhered firmly to the subjacent parts; I therefore withdrew the seton.

As he now found his health tolerably good, and being, as he thought, recovered from what he considered as a dangerous complaint, and imagining that he was made weaker by staying in the hospital, he went into the country, promising to inform me if any change happened; but I have not since heard of him.

CASE XIV.

February, 1791. James Leaver is in the 21st year of his age, has light brown hair, blue eyes, dilated pupils, pale countenance, frequently flushed, and is apparently of an irritable constitution. About nine months ago he was affected with a pain in his loins when he moved, which soon became very severe, even when he was at rest. This pain was accompanied with fever. Four months afterwards he perceived a small swelling in the upper part of his right thigh, which has since gradually increased, and has now descended nearly to the middle of the thigh: he remarked,

that he never had the least pain in the part where the tumour was formed. After the appearance of this swelling, he no longer experienced the same degree of uneasiness in his loins; and shortly after, he acquired the power of lifting up his right thigh, which he had for some time lost.

For four months previously to his admission into the hospital, he had regularly profuse night sweats, which began about twelve o'clock, but did not prevent his sleeping; when he awoke he found his clothes very wet, and himself very chilly; he had, however, an appetite for his breakfast.

On the 5th of February, Sir James Earle introduced a trochar into the most prominent part of the tumour: between two and three pints of healthy matter were evacuated, the wound was immediately closed, and lint and adhesive plaster were applied. The night succeeding the operation he slept little, but was free from perspiration. On each succeeding night he slept as usual, but had not in the least degree those sweats which had been constant until the discharge of the matter.

On the 8th of February, he said he found himself no worse for the operation, he was free from night sweats and slept soundly. His appetite was perfectly good, his bowels unaffected, and his tongue moist and florid. His pulse, before the operation, was ninety, and, for fifteen days afterwards, it varied between that and a hundred. February 15th, ten days after the evacuation, his night sweats returned, although in a less degree than formerly.

February 26th, three weeks after the first discharge, the tumour had now become nearly of its original size; the integuments were much distended; the part punctured by the trochar had, for three days, appeared inflamed; and, on the tumour being now compressed, the cicatrix gave way, and the contained matter oozed from the orifice. The trochar was again introduced through the former ori-

fice, and eight ounces of brownish matter discharged. The wound was carefully dressed, in hopes that as the distension was taken off, it might close. After the second evacuation, the night sweats again ceased ; he said he was rather weaker, but no other alteration in his health was perceived.

On the 2d of March, while in the act of coughing, the imperfectly healed wound, made by the trochar, gave way. Very little pus was discharged, but as it was impossible to heal this ulcerated opening, and as the continuity of the cyst was now destroyed, the mode of treatment hitherto pursued was frustrated. Much inflammation of the cyst immediately took place, and the constitution became greatly affected. The next day, if the finger slightly compressed the abscess, it gave him great pain ; but, before the cavity of the abscess became exposed, the part was perfectly indolent. When pressure was employed, a fœtid, frothy matter issued from the ulcerated orifice. The cyst, however, was emptied, and, except when pressed, there was no discharge. Such were the appearances of the part. The general disturbance of the constitution was also very great ; his countenance exhibited strong expressions of alarm ; if any one approached him he started, and when any one touched him he trembled. His pulse beat from 130 to 140 in a minute—for two days his bowels were disordered—however, the inflammation of the cyst gradually abated, and in like manner the constitutional derangement subsided. At the end of about eight days he was much amended, and in about six weeks the abscess appeared nearly well, and his constitution relieved from febrile indisposition.

In this case it is clear, that the second discharge of matter was too long delayed, and to me it appears equally evident that the patient derived much advantage from the mode of treatment which had been pursued ; for by it the

complaint was reduced from a large abscess, containing nearly three pints, to one which held less than eight ounces. Yet, even in this diminished state, great derangement of the constitution followed the exposure of the cavity of the abscess: indeed, I have little doubt, if the abscess had been opened whilst it retained its original dimensions, but that the patient would have fallen a victim to the more extensive inflammation, and more violent fever, which would then have taken place.

CASE XV.

Elizabeth Ridley, aged fifty-five, had, for one year and a half before her admission into the hospital, suffered much from bad health; she then had a severe cough, accompanied with much fever. About ten months before she was admitted into the hospital, she had a very acute pain in her loins, which abated, in some degree, ten weeks after its first attack; at that time she observed a tumour in her groin, which had gradually increased in size. The pain had been continual though at intervals it suffered considerable abatement; the veins on the fore part of the thigh had become varicose and the leg œdematous. The tumour was of a circular form, about four inches in diameter. It had much protruded the fascia, and matter was violently impelled into it on coughing. She now complained of occasional pain of her stomach, of failure of appetite, and a costive state of her bowels: her pulse was slow and feeble, her tongue pale, and her health considerably beneath the natural standard.

On the 8th of November, I punctured the lower part of the tumour with a lancet, carrying it obliquely about half an inch between the skin and the fascia, and discharged eleven ounces of good pus, but did not empty the abscess. The orifice of the skin and cyst did not then correspond,

and on coughing there there was still perceived a considerable impulse of matter from the cavity in the loins. I was unwilling to irritate the cyst by the introduction of any instrument to separate the lips of the wound, therefore I closed the orifice with sticking-plaster, and every thing remained quiet till the third day, when, by a fit of coughing, the orifice was burst open, and matter oozed from beneath the plaster. If I suffered it to remain open, my original plan of treatment would be frustrated. I therefore resolved to let out the collected matter, lest distention of the fascia and integuments should prevent the wound from healing. I again introduced the lancet through the same orifice, and wounded it so as to make it bleed and give a discharge to five ounces of pus; the abscess, however, did not even now appear to be completely emptied.

The woman suffered no evident alteration in her health, but became much easier with respect to her loins. The varicose veins and the œdema of the leg now no longer appeared. These symptoms, doubtless, originated from the pressure in the loins, occasioned by matter, of which it was very evident there was a large collection.

On the 18th, the tumour was again punctured, and eight ounces of fluid evacuated. The matter before had been incompletely discharged; now I believe the tumour was entirely emptied. This last discharged matter was perfectly inodorous and the thigh uninflamed. I made this aperture at the side of the tumour with the edges of the lancet upwards and downwards, and not transversely as the former openings had been made. This I did that the efforts employed in coughing might have less effect in impelling the matter through the orifice, which soon healed.

In the following week she complained that she was restless and could not sleep, neither had she her usual degree of appetite; her pulse, however, was not quickened, nor

did any other signs of constitutional indisposition appear. No matter was now collected beneath the fascia, and after waiting another week without any apparent collection being made,on the 25th of November I introduced a lancet through the fascia of the thigh, with a design to leave the cavity of the abscess permanently open. I did not perceive any matter issue from the opening. As the integuments covering the faicia were thickened, and showed some disposition to inflame, I directed the aqua plumbi acetati to be applied to them. On the following day some matter flowed through the orifice. The patient supposed, if collected, it might be a table-spoonful; nearly the same quantity continued to discharge for about a fortnight, and afterwards it gradually diminished, and the wound healed. She was not affected by fever in consequence of this last opening, and seemed to suffer very little inconvenience with respect to her health. She, however, complained much of pains resembling those of the rheumatism, which affected principally her hips, though sometimes they attacked her loins; for these pains she was placed under the care of the physician, and as her constitution was languid, she was recommended to continue the medicines prescribed for her as an out patient.

In this case one circumstance appeared to me curious; after I had twice discharged the contents of the abscess, no farther collection of matter took place. Yet not because the cavity of the abscess was abolished, but because from some little indisposition of the constitution the secretion into that cavity was for a time suspended. This, however, was rather an advantageous circumstance, for as the cyst was empty, the contraction of the sides was unopposed.

CASE XVII.

Charles White, thirty-six years of age, and not unhealthy, had a lumbar abscess, which presented beneath the fascia of the thigh, and which there was no reason to suppose connected with any disease of the spine. From this abscess, I discharged, by puncture, twenty-four ounces of healthy pus, and healed the orifice. The patient suffered some weakness and derangement of health; but they were not considerable. The operation was repeated every fortnight; and by the fifth time of performing it, the quantity had decreased to four ounces. At the end of another fortnight, I made the opening to discharge the matter, larger than common, and did not attempt to unite it, but directed a poultice to be applied to the thigh, and the patient to be kept in bed. No perceptible derangement in his health took place in consequence of this. The lips of the wound granulated, which, I think, is always a good sign; the fascia seemed to adhere to the parts beneath; and in the course of a month he was thought well enough to leave the hospital, although there was still some matter discharged from the wound. In a few weeks more, the part was entirely healed; nor had he afterwards any return of the complaint.

CASE XVIII.

William Hankes, when about twenty-eight years of age, had a collection of matter formed in his loins, which descended beneath Poupart's ligament, and elevated the fascia of the thigh. The formation of this matter had not been attended with pain; neither were the motions of the thigh impeded during its collection. The elevated portion of the fascia was about three inches in length, and two in breadth; and the impulse communicated to it from the

loins, on coughing, was distinct though not very forcible.— I punctured the abscess, and discharged twelve ounces of pus, in which there were some flakes of coagulum. The wound healed speedily, and the patient not only suffered no inconvenience, but even found himself better than before the operation. After three weeks' time, the matter which was collected gave so little prominence to the fascia, that, when I punctured it, I was apprehensive of injuring the subjacent parts; and not more than between five and six ounces of pus flowed from the orifice on this occasion. As the quantity of matter contained in the abscess at first was small when compared with that in many other cases which terminated well, as the patient also was young, and apparently capable of sustaining the degree of irritation likely to ensue, I thought there was no great risk in leaving the orifice unclosed. Accordingly a poultice was applied over the part; and I hoped that by thus endeavouring as much as possible to lessen inflammation about the wound, I might prevent any considerable degree of it from taking place in the cyst. For some time the fascia felt sore, and was painful when the integuments were pressed; but this tenderness abated in about ten days; the discharge also lessened, and there appeared ground to hope that the patient would soon get well. He was now attacked with pain in his loins, accompanied by fever: the discharge also increased, and had a fœtid smell. The symptoms, however, gradually abated, but left the patient greatly reduced in strength. After a short interval, he again experienced a similar relapse and recovery, by which his weakness was still farther increased. He had been occasionally troubled with cough, which now became very constant, but without any expectoration; and I observed that he drew in very little air when he inspired. As the abscess dis-

charged largely, and the strength of his constitution was rather declining, I made a large issue in the integuments of his loins, with a view to lessen the internal disease. This seemed to be of great service; for the pain of his loins went off, and the discharge from the abscess abated gradually, and at last became inconsiderable. Still, however, he did not recover his health; and the country air was now recommended by Dr. Latham, who had prescribed for him during his illness, those medicines which his disorder seemed to require. He accordingly left the hospital, and, at the end of ten months, returned to town; when the wound in his thigh still continued to discharge a small quantity of matter. Afterwards, a thickening of the integuments on the front of the thigh took place; and two or three small ulcers formed there, which did not readily heal, but were sometimes in a better and sometimes in a worse state. I saw him occasionally, for two years, during which time he had tried the effect of sea-bathing. His health, however, was not good, though it did not appear to me to suffer from the remains of the abscess, which neither occasioned pain, nor hindered his walking. At last, his strength declining, he was again admitted into the hospital, under Dr. Latham's care. He was now much troubled with cough, and hectic fever; and, under the fascia of the other thigh, opposite to the dorsum of the ilium, a fresh abscess appeared, which, however, had no communication with the abdomen. The powers of his constitution were now evidently broken, and he gradually sunk, and died.

Being greatly hurried during the only opportunity I had of inspecting the body, my examination of it was very cursory. I can, therefore, only say that both lungs were irregularly and generally indurated; that the cavity of the ori-

ginal abscess still remained opened, but was contracted into a narrow fistula leading from the thigh to the middle of the psoas muscle. There was another large abscess on the opposite psoas muscle, which had not yet descended to the thigh, where, as has been already mentioned, there was also an abscess of considerable magnitude, but unconnected with this in the loins. The lumbar vertebræ were perfectly sound.

That the death of this man was not owing to the original abscess in the loins, is to me very evident. That abscess did, indeed, for a considerable time, greatly disturb his constitution; but it afterwards became indolent, and acquired a state incapable of exciting irritation.

CASE XIX.

Having unfortunately lost the minutes which I took of the next case that occurred in the hospital, I can only give such a general account of it as my memory supplies. The subject of it, Doods King, who was under the care of Mr. Blicke, was about thirty years of age, and of a very sickly aspect. The abscess presented beneath Poupart's ligament; it contained at first about 20 ounces of curdly matter, and was punctured four times, with the usual progressive reduction in the quantity of matter discharged: but before the fifth time of opening, one of the punctured places ulcerated. There was, indeed, from the beginning, in this case, a great disposition in the skin to inflame and ulcerate, and it was with difficulty I could heal the orifices made to let the matter out. As soon as the cavity had thus become open, a poultice was applied to the part, and confinement to bed strictly enjoined. The patient became somewhat weaker, but no fever ensued. I did not suffer

him to go about, however, for a long time, lest the motion of the parts should induce inflammation. The abscess at last became perfectly indolent itself, and unirritating to the constitution; but it did not show much disposition to heal. He was discharged in this state, and promised to apply again if his complaint became troublesome. I saw him about a month after his dismission, when he mentioned a design of going into the country; since which I have not heard of him.

CASE XX.

Catharine Vallance, nineteen years old, of a healthy appearance, but having a considerable inclination of her body forwards, from a former disease of the dorsal vertebræ, had, for twelve months before I first saw her, laboured under severe pain of her loins, accompanied with fever. There was at that time a large lumbar abscess, the matter of which had descended to the upper part of the thigh, where it distended the integuments, so as to render them prominent and thin. A surgeon pricked this tumour with a lancet, and let out more than a pint of very healthy pus; by which the bulk of the swelling was scarcely diminished: but as no more matter would flow, a piece of sticking-plaster was applied over the orifice. Four days afterwards another surgeon, observing that the integuments were inflamed, and the punctured part much disposed to ulcerate, made another aperture, at some distance from the former, and discharged three pints of good pus; which completely emptied the cavity. The last puncture being attentively closed, healed readily; and the first lost its disposition to ulcerate. The young woman continued perfectly in health for ten days, when some little distention of the abscess again oc-

curring, the first puncture ulcerated; in consequence of which the collected matter made its way out, and left a permanent opening into the cavity. Considerable fever now came on, the patient's pulse was rapid, her tongue white, and her skin hot and dry; but these symptoms abated after a short time, and she again recovered her former state of health; the abscess not falling into any secondary state of disease after the inflammation went off; nor did any hectic fever take place after the first derangement of the constitution had subsided.

Another abscess now presented itself, in the same situation, on the opposite side. As soon as this had acquired sufficient prominence to give security to the parts beneath, it was punctured; twelve ounces of healthy pus were let out, and the orifice was closed. When the matter collected again, the wound, made to discharge it, was suffered to remain open. The inflammation which took place in the cyst in consequence of this, was very slight, and hardly affected the constitution; the parts soon became indolent, discharging but little matter, and both the abscesses healed gradually.

It is now three years since that case occurred; and I have lately seen the patient, who has experienced no inconvenience from the complaint since that period.

CASE XXI.

A young woman had a lumbar abscess presenting in the upper part of the thigh, from which a surgeon discharged, by puncture, nearly a quart of matter, and healed the opening. At the expiration of a fortnight, a second puncture was made, and twelve ounces of matter let out. The last orifice was closed like the first, but after a few days it ulce-

rated, and the cavity of the abscess became exposed. The patient now growing very ill, was admitted into St. Bartholomew's Hospital. Her pulse was weak, but not deficient in strength; her tongue white, and her skin hot and dry: the discharge from the abscess was not great, but the pain of her loins was very severe. A large poultice was applied to the thigh; and the common saline mixture, with small doses of antimonials, was given. In the course of a week, a considerable change took place; her pulse, though still quick, was rather feeble; her tongue moist, and not furred; and she had frequent perspirations, without any evident cause; the pain in her loins abated considerably, and the discharge from the abscess became copious, thin, and fœtid. She now began to take the Peruvian bark, and in the space of a month gradually recovered from this state of debility. Having acquired strength enough to sit up, and to walk a little about the ward, she one day imprudently went into the air, and walked until she was much fatigued.

The consequences of this were, a return of the pain in her loins; with quickness and hardness of her pulse, white tongue, and hot and dry skin. As the pain and fever went off, they were succeeded by an increased discharge from the abscess, and irregular perspirations, which gradually abating, the abscess at length became indolent, and no longer affected the constitution. Warned by her former experience, she now took exercise very cautiously; and when she found she could bear motion without exciting irritation in the abscess, she went into the country, where she regained her health; the abscess healed, and she has since continued perfectly well.

When a permanent opening is made in a lumbar abscess, the part generally falls into a morbid state, and this is accompanied by a sympathetic affection of the constitution.

corresponding in its nature with the local complaint. In the first of the two cases just now related, both the local and constitutional disease were of a more purely inflammatory kind, than in any other that I had ever seen, nor was it succeeded by that ill-conditioned state of the sore, accompanied with a thin fœtid discharge, and hectic symptoms, which so frequently occur in this disorder. In the second case, as the patient's general health was tolerably good, the disease in the beginning approached to the nature of common inflammation, then gradually acquired the usual state of these abscesses, but afterwards became indolent; the sympathetic affection of the constitution exactly corresponded to the state of the abscess. At first the fever was inflammatory, then hectical; and when the local complaint became indolent, the general state of the patient's health was no longer affected. These circumstances still more strongly appeared after the accidental re-excitement of the inflammatory symptoms.

In order further to confirm the foregoing opinions, I may add, that I have known a considerable space of time elapse, between the first bursting of a lumbar abscess and its assuming that morbid state which is so peculiar to those diseases, and which produces a corresponding affection of the system in general.

THE

HUNTERIAN ORATION,

FOR THE YEAR

1819.

DELIVERED BEFORE

THE ROYAL COLLEGE OF SURGEONS,

IN LONDON;

BY

JOHN ABERNETHY, F. R. S., &c.

HUNTERIAN ORATION,

1819.

IT is the expressed intention of the founders of this oration, that it should be rendered contributory to the honour of surgery, and of its intelligent professors ; which design cannot, in my opinion, be better accomplished, than by showing what surgery really is ; the nature and extent of the knowledge requisite for its clear comprehension ; the intellect and talent necessary for its successful practice.

Had surgery and surgeons been merely what their names imply, handywork, and handicrafts, I never would have appeared before you, Gentlemen, to do them honour. For honour is due alone to intellect, and can be paid to nothing else. Why do we honour those whose literary labours stand pre-eminent ; or those who have exposed, or sacrificed their lives in the cause of their country, or in that of moral obligation ? Is it not on account of their having evinced superior powers, or firmness of mind ? They have thus done honour to the whole human race, and can only be repaid in the same coin ; we return to them the tribute of honour, in proportion as they have conferred it on us. We indeed honour rank, but then it is either in blind obedience to the laws of custom, or because we associate the opinion of superior intelligence and elevation of mind with the possession of a dignified station.*

* The good qualities of the mind excite and engage our respect or esteem.

Now, to show what surgery really is, it becomes necessary to divest it of that garb with which it has been clothed and obscured in times of ignorance; and it is useful to revert to the history of former times, in order to observe the circumstances which have promoted or retarded the progress of the medical sciences, or communicated to them that bias, by which they have been directed to their present situation.

Medicine, or the science which has for its object the prevention and cure of diseases, was held in the highest respect by ancient nations, and its most eminent professors were even venerated. But, surely, it was the beneficent object only of the science that attracted their applause and gratitude; for the means by which the object was to be accomplished were either not contemplated, or were merely supposed to be known. Various sovereigns have, doubtless, greatly promoted this science by their patronage, and encouragement ought to be given to it, as I shall afterwards show, not only by the government of countries, but also by the people in general. The successors of Alexander of Macedon first resolutely opposed the natural feelings and prejudices of mankind, by patronising the dissection of human bodies at Alexandria; which city they had made the great depository of knowledge, by the collection of an immense library, and which they also strove to make a splendid seat of science, and source of instruction.

It was at Alexandria, that persons in general first possessed the ready means of knowing what others knew and thought, by consulting their writings collected in its stupendous library. How different must have been the state of learning and learned men in ancient and in modern times! What surprising changes has the invention of printing produced! An ancient student of any subject of nature or sci-

ence must have sought for the information which others possessed, by distant visits, to procure the perusal of any work of celebrity, or the conversation of those engaged in the same pursuits. His knowledge, therefore, must chiefly have resulted from his own exertions, and if he deemed it worthy of being recorded for the benefit of others, he knew that it must be communicated to them very gradually and slowly. His fame, as a discoverer, or improver of science, could never spread so as to reverberate to his own ears. His reputation must necessarily be of slow growth, and therefore his endeavour would be to make it lasting. As he could not compare his knowledge with that of others, he would strive to make his own perfect, by completely mastering the subject he had engaged with, so that none should be able to do more. But now, when, by an industrious education, any one may possess himself of the knowledge of the whole world with respect to any subject of nature, art or science; now, when every accession of knowledge is published at annual, quarterly, or monthly periods; every little discovery is at once proclaimed, lest its author should be anticipated; and persons in general become desirous of contending for superiority more with one another, than with the subject, or with themselves. Yet this ready communication of knowledge greatly tends to its increase, by exciting general emulation and co-operation.

It was at Alexandria, also, that persons of the medical profession first possessed an opportunity of studying the subject-matter of medical science, the structure and functions of the parts of the human body. How absurd should we deem the conduct of a mechanic, whose business it was to rectify the errors of any complex machine, should he merely provide himself with the finest and fittest tools for the purpose, and neglect to learn its mechanism, by which

alone he can be able to discover the causes of the error, or stoppage of its different movements, and consequently what is wanting to be done, to render it again perfect or useful. Yet equally absurd would be the conduct of medical men, were they to study botany, pharmacy, chemistry, and natural philosophy, searching indeed through all the paths of nature, and the stores of art, for means of cure, and yet neglect anatomy, by which alone they can be able to distinguish the nature of the difference between health and disease, and consequently what is requisite to reconvert the latter into the former; which is the only circumstance that can render medicine a science.

It seems to be my fate, Gentlemen, whenever I address you, to be doomed to speak of the importance of opinions; yet I cannot avoid it, the necessity of the case absolutely demands it; for the reasoning powers of man, which, when well directed, lead to the discovery of truth, and the formation of useful opinions, when misemployed, elicit nothing but error and pernicious notions. It is a very great but very common misemployment of our reasoning powers, to draw inferences from facts belonging to different subjects, which are incommensurate with one another. Such irrelevant facts have been often designated by the whimsical and contradictory expression of false facts. We are indeed sometimes induced to reason from analogy, but then the similarity of the facts is so precise, as to warrant us in believing that the subjects, concerning which we thus comparatively reason, are essentially alike.

Now without any knowledge of anatomy, or the animal economy, persons of the medical profession, by drawing inferences from mixed facts, might suppose, that a fire was kindled throughout the body to warm and cherish it, which if in excess, might set our juices into fermentation, and

thus produce partial or general disorder; they might suppose, that there were elements in the body, which ought to be combined in definite proportions, and that different diseases might result from the excess or deficiency of one or other of these elements. They might suppose, that diseases were of an acid or of an alkaline nature; they might say, that there were powers, capable of performing functions, nay even poetically imagine essences endowed with such powers, and speak of animæ presiding over the different functions, and of an archæus or master-workman superintending the whole. You know, Gentlemen, that all this and more of the same kind has been thought and said by reputed sages of the medical profession.

Since, then, reasoning from false, insufficient, or irrelevant premises is productive of error, we cannot wonder, that when medical men in general first began to reason on the causes and nature of diseases, and the effects of remedies, if their speculations were wild, and the conduct which such opinions gave rise to, highly injurious. We can feel no surprise, therefore, that a large party of the medical profession should segregate themselves, and resolutely interdict the use of reasoning in medical practice, steadfastly resolving, in their conduct to be guided solely by the dictates of experience. Neither indeed can we wonder, that even erring reason still found advocates in the minds of men. Now you know, Gentlemen, that not very long after the formation of the Alexandrian school, in the beginning of the second century, before the Christian æra, Serapion and Phillinus, pupils of Herophilus, were the founders of a sect called the empiric, which was numerous, highly respectable, and which long continued to flourish, whilst the remaining party of the medical profession were distinguished by the appellation of the dogmatic or rational sect. In the very feeble and almost blind state attendant on the infancy

of medical science, a caution not to attempt to advance, unless supported and conducted by an unerring guide, seemed really requisite, yet to prohibit such endeavours in the present vigorous and enlightened state of medical science, would be as preposterous as to recommend the conduct proper to be pursued in infancy, to be continued during the whole state of manhood. Though much might be said on this subject, it really seems unnecessary to do more than to remind you, Gentlemen, that the sagacious Lord Bacon has in this respect also, well displayed the results of different dispositions or powers of mind, by the following simile. "The empirics," says he, "like ants, only lay by stores and use them; the rationalists, like spiders, spin webs out of themselves; but the bee takes a middle course, collecting her matter from the flowers of the field and garden, and digesting, and elaborating it by her native powers."

It was shortly after the establishment of the Alexandrian school, that, as Celsus informs us, the practice of medicine was first separated into three parts, and each part consigned to a different person, one of whom was supposed to cure diseases by compounds of drugs and other substances; another by regimen and plans of diet; and the third by manual operations and instruments. This partition seems to have been both an effect and a cause of that confusion between the object of medicine, and the means of accomplishing it, which has obtained more or less ever since that period. The bulk of medical knowledge, was, however, at that time too diminutive, to permit this subdivision to be continued, and we find succeeding authors treat equally on all these curative measures.

The advantages which we derive from anatomical knowledge are, that it enables us to judge of the nature and probable event of injuries and diseases, by the exact information we possess of the situation and connexions of every part of

the body; that it enables us to perform the operations of surgery with confidence in ourselves, and security to our patients; moreover, a correct knowledge of structure is the only foundation of all knowledge of function, without which, we can never be able to distinguish the nature of the difference between health and disease, nor consequently what is requisite to reconvert the latter into the former, which, I repeat, is the only circumstance that can render medicine a science. Now, though the dissections at the Alexandrian school, were by no means so perfect as to produce any of the important consequences derivable from anatomy, yet they led the way to the general investigation of structure and function, and to the formation of opinions deduced from the facts belonging to the subject under consideration. The body of the monkey so much resembles that of man, that a moderately good idea of the latter may be obtained by the examination of the former; the desire to understand function would also lead to experimental enquiry; and consequently we find Galen, whom they say had passed several years at the Alexandrian school, making various experiments on animals, to determine the office of different parts of the body.

Medicine was, doubtless, much promoted by the opportunities of information which the Alexandrian school afforded; and it seems to have proceeded as prosperously as could be expected, in the still very deficient state of elementary knowledge, for several centuries; when a revolution happened, by which all the sciences of southern Europe were in common overthrown, and their lights extinguished, so that a great district of the world was involved in darkness and ignorance for many ages. As the account which I am giving of the causes that promoted, retarded, or variously affected the progress of the medical sciences,

will not be clearly intelligible. without adverting to this revolution, I may be excused if I briefly endeavour to revive it in your remembrance. It was towards the latter end of the fifth century, that the hardy nations of the north of Europe burst like a deluge into the Italian territories of the degenerate Romans, bearing down before them the ancient seat of their government, which, having previously removed to Constantinople, was still able to oppose a mound that checked the further progress of this inundation. In the beginning of the seventh century, Mahomet established his religion and dominion in the East, subduing all Arabia; and his successors extended their empire over Palestine and Persia, Egypt, and the northern coast of Africa, from whence their influence was continued over those Moors, who had invaded and subdued the kingdom of Spain: such was the extent of the Saracen dominion. But the Mahometans were prevented from entering Europe on the east by the Roman government at Constantinople. The territories of the Romans were much diminished, and were assailed on various parts of their frontier. The empire, however, was still superior to these attacks, and according to the simile of a late elegant writer, it seemed like the trunk of an old tree, which still remained vigorous and unshaken by the winds which assaulted it, and had stripped it of its branches. In the territory protected by the last exertion of the Roman power, science and art still survived, though in a state of rapid decline. Here the works of the Grecian and Roman writers on medicine, were chiefly preserved, and their languages were spoken. Here too, when the people in general had become illiterate, ecclesiastical scholars, who had read these authors, took upon themselves to give medical advice, but refused to shed blood, or dress wounds or sores, which task devolved on their servants. It

was here, therefore, that surgery first made its public appearance, clothed in the garb of a menial.

Anatomy was wholly neglected by the Arabians, nor was it till the beginning of the fourteenth century, that Mondini made public dissections in Italy, and by degrees, other nations acquired " that useful boldness." The zeal of the great painters, who began to flourish towards the close of the next century, and the patronage afforded to them, greatly contributed to the suppression of the public prejudice against dissection in Italy. Michael Angelo, Raphael, Leonardo da Vinci, and Albert Durer, were all either frequent dissectors, or draftsmen of dissected bodies. It is curious to observe, how speedily in general we reconcile our minds to that which custom has rendered familiar. The dissection of the bodies of persons who die in the hospitals of Paris, produces at present no indignation, no sensation in the public mind. Yet even in the time of Haller, the laws and prejudices against purloining a dead body, were so strong, that he left France with all possible speed, lest the receiver should be considered as bad as the thief.

It was not, however, until the sixteenth century, that anatomy made any considerable advances, when some great anatomists distinguished themselves, particularly Eustachius and Fallopius in Italy, Sylvius and Vesalius in France. Vesalius pursued his anatomical enquiries with so much ardor and constancy, that he was able to publish seven large folio volumes on the anatomy of the human body, before he was 29 years of age (1542). These books, which entitle him to the greatest gratitude of posterity, were to himself, however, the cause of much vexation and trouble. Even at that time, the authority of Galen was held in such high respect, that when Vesalius showed his errors, and his ignorance of the structure of the human body, the ha-

tred of all was turned against the defamer. People could not bear to be set right by so young a man, and even his preceptor Sylvius denounced perpetual enmity against him. I need not tell my present auditors what scrapes Vesalius got into, or what injuries he sustained, in consequence of the public prejudice against dissection.

After human anatomy had become moderately well known, the different nations of Europe were involved in war, and the same attention was not paid to the support of academical institutions, for teaching anatomy and medicine. Therefore, anatomists again had recourse to the dissection of animals, from which, however, they derived very important advantages. They were thus led to an extensive knowledge of the comparative structure of living beings in general, and to make observations and experiments illustrative of function. So that by these means, were all the paths leading to medical science fairly thrown open to enquirers.

I must now relate some ridiculous circumstances, which, however, gave a considerable bias to the progress of the medical sciences. The priests, merely because they were able to read the Greek and Roman authors on medicine, were the principal physicians, during the dark ages, as I may call them, of these sciences. They became intimate with the barbers, because the latter were frequently employed to shave the heads of the priests, according to the uniform of their order. The priests also frequently employed the barbers to shave the heads of patients, before they prescribed washes to cool the fever of the brain, or blisters to draw the peccant humours from the surface. Finding these fellows handy with edge tools, the priests taught them to bleed and perform such little operations as they were competent to direct, as well as to make salves and poultices, and to dress

wounds and sores. Such was the origin of barber-surgery. When, however, the Popes perceived that the medical practice of the priests took them from their proper calling, and obliged them after various edicts, reluctantly to relinquish it, the office of physician was then adopted by other scholars upon the same claim or pretension, that of being able to read the Greek and Roman writers on medicine; and ever since, scholastic learning, and academical honours, have been considered as essential attributes to the character of a physician.

In the fourteenth century, these barbers and reputed surgeons pushed themselves forward into the practice of surgery in France, to a degree that induced the surgeons in ordinary to petition the legislature to interfere, and an order was obtained that the barbers should not be permitted to practise, except in slight cases. In process of time, however, the barbers attended lectures, and became as well informed as the inferior class of surgeons, and being still patronised and instructed by their old friends the learned doctors, they at length obtained an establishment as regular practitioners in France, under the title of barber-surgeons. Of this order was Ambrose Pare, a man of original observation, great candour and abundant experience, whose works were well calculated to correct the bad and cruel surgery of those times.

Wherever the priests practised as physicians, the barbers performed the offices of surgeons. As, likewise, medical knowledge radiated from Italy to the northern nations of Europe, so they must have received the information mixed with any absurdity which it might have taken up in its passage; and this, if we had even the discernment to distinguish, we seem to have wanted the resolution to reject, for the copartnership between surgery and shaving has been

but newly dissolved in this country. "Would heart of man e'er think it, but you'll be silent." This foolery was continued so nearly to the present time, that even I myself have often doft my cap to barber-surgeons. Edward the Fourth, in the year 1461, granted a charter of incorporation and privilege to barber-surgeons; and though the distinct nature of the two professions gradually became more and more apparent, yet they were not separated till nearly three centuries had elapsed, till the year 1745.

The legitimate practice of surgery did not, however, remain uncultivated nor unpatronised by different sovereigns. My time does not permit me to relate various instances, and I question if more than one can be adduced, in which the means adopted were judicious and efficient. Louis the Fourteenth, from being continually engaged in war, seems first to have clearly discerned the nature and importance of surgery, and the proper measures by which it might and ought to be promoted. He established hospitals, colleges, and professorships; he ordered that lectures on surgery should be given by surgeons of acknowledged ability, and that bodies for dissection should be liberally supplied. By these means, he produced such a spirit of enquiry and emulation amongst the members of our profession, that the French surgeons soon surpassed those of all other nations, and pupils from every part of Europe flocked to Paris to learn anatomy and surgery. As a further consequence of this patronage, I may mention that it gave rise to that very excellent work, the memoirs of the French Academy of Surgery, the contributors to which were laborious students of their profession, who regularly registered and arranged all the knowledge promulgated by preceding authors, to which they added their own observations and experimental enquiries.

It would, in my opinion, be honourable to the surgeons of any nation to combine and produce a rival work (due allowances being made for the progressive improvement of the science of surgery); for to me, these memoirs seem, even at present, to stand as it were alone, and in a state of lofty superiority. Let me not, however, omit to mention that before these memoirs came forth, a similar publication was set on foot in this country under the patronage of the first Professor Monro of Edinburgh.* It is unnecessary for me to tell you, Gentlemen, of the number and importance of the periodical publications of our own country. The facility of publication, which such works afford, prevents useful information from being lost, whilst they keep alive amongst the members of our profession in general a spirit of enquiry, emulation, and co-operation.

Having thus adverted to the principal circumstances which have influenced the progress of the medical sciences, it seems only necessary to show the improvements made by the two late eminent physiologists Haller and Hunter, in order to place distinctly within your view the present state of these sciences in our own country, which is my chief object in this address; for indeed it would be of but little use to look back, except in order to determine the direction and means by which we are likely to proceed with the greatest advantage.

Albert Von Haller was born at Berne, in Switzerland, in 1708, and died there in 1777. He possessed a well proportioned assemblance of vigorous intellectual faculties. His memory was surprisingly quick and retentive, scarcely any language was unknown to him, and all those in which

*The Edinburgh Medical Essays and Observations were first published in 1732. The Memoirs of the French Academy of Surgery in 1743.

medical records are written he both read and wrote with facility. He had great industry, and made himself acquainted with all that others knew or thought relative to our professional studies. He had great method and discrimination, and regularly registered all the knowledge he obtained by reading or otherwise. Of his talents in selecting, condensing, and arranging information from successive publications, his numerous bibliothecæ afford ample evidence. Haller went to Leyden in 1725, where he became a favourite pupil of Boerhaave, and a fellow-student of Albinus. He also took opportunities of visiting Ruysch, to observe his anatomical labours. After he had finished his studies and his travels, he returned to Berne, and in 1734 he taught anatomy in an amphitheatre which the republic had established for that purpose; he was also physician to an hospital, and entrusted with the care of the public library, and cabinet of medals. In the first year that he undertook the latter office he formed a regular catalogue of all the books, and arranged and described in chronological order more than 5000 antique medals. King George the Second being desirous of promoting the reputation of the University of Gottingen, invited Haller to accept of an anatomical, surgical, and botanical professorship, which he established for him; and Haller accepted this invitation. The opportunities of information at the school of Berne were too small for the mind of Haller, and he there met with the usual difficulty of procuring bodies for dissection.

Haller resided in Gottingen seventeen years, and made physiology his principal study. He found the knowledge of this subject encumbered and perplexed with false and absurd assertions and doctrines, which he removed, and endeavoured to make physiology as much like science as possible. He saw the necessity for an exact knowledge of

anatomy, both human and comparative ; for any reasoning with respect to function which is incompatible with the facts relating to structure must be invalid. He saw no mode by which function could be scientifically investigated, except by experiments made on living animals ; yet in detailing these, we find frequent evidences of his being disturbed by those " compunctious visitings of nature" which every good mind must necessarily feel at inflicting sufferings on unresisting or subdued sensitive creatures, over which nature has given us dominion. He examined all the principal vital functions with particular attention, yet he found no spring of vital action except in irritability, which he believed to be a property of the muscular fibre alone. He investigated the process of formation, both in the growth and reparation of bones, and in the formation of the embryon in the egg, which he believed to be developed. It was not, however, till after thirty years of labour that he thought himself warranted to publish his Elementa Physiologiæ, a work that certainly contains all that was then known on physiology, together with the alterations and improvements made by his own enquiries and reflections ; and its supreme excellence, at the time of its publication, was testified by the applause of every nation, and by proffers of invitation and reward to its author by various governments. The Nostalgia of Haller, however, induced him after seventeen years' residence in Gottingen to return to Berne, where he became a magistrate and politician, without relinquishing his former studies. Such was the esteem with which Haller was regarded, wherever the sciences were cultivated, that most foreigners of distinction, and even princes, in passing through Switzerland. paid homage by their visits to the illustrious Haller.

John Hunter was born in the county of Lanark, in Scotland, in the year 1728, and he died in London in 1793. He had received but little education; his mind had not been taught to act in imitation of others; he disliked to read, as much as he liked to think. When Mr. Cline addressed the College on this anniversary, he said, "Much as Mr. Hunter did, he thought still more. He has often told me, his delight was, to think." Mr. Hunter did not begin to learn anatomy till he was eighteen years of age; but when the book of nature lay exposed to his view, he read it with facility, interest, intelligence, and diligence; and the idle youth became a most industrious man. Like Haller, he devoted himself to physiology. Such minds could not but be highly sensible of the interest and importance of this study: they could not be contented with the mere notation of facts, without enquiring into their probable causes and uses. Like Haller, he became an exact and comprehensive anatomist. No structure, nor substance wanting structure, yet possessing life, escaped his strictest scrutiny. Like Haller, he investigated the nature of function by experiment, yet how different is the conclusion of the labours and reflections, or the principles of the physiological doctrines of these almost contemporary and very extraordinary characters;—the one enriched from the possessions of all others, and endowed with great degrees of intellectual powers; the other, rich only in natural genius and talent.

Although I have not now to speak of Mr. Hunter's physiological opinions, yet it seems proper to observe on the present occasion, that he was not satisfied with those of Haller, which he had heard delivered in his brother's lectures; and therefore he examined every subject for himself. He seems also to have wrought like an ancient student, not striving for victory with others, but contending with the subject,

and with himself. In the whole of his labours and reasonings, we may perceive a most diligent search for every fact belonging to the subject he was investigating, to form the basis on which he reasons; the most anxious solicitude to describe facts with accuracy, and to avoid the least misrepresentation of them; and in his reasonings, I can perceive no inference deduced from insufficient or irrelevant premises. It is this mode of proceeding only, as I have formerly observed, which can give value and currency to the opinions of any one. Mr. Hunter was convinced that life was not the result of organization; and though many may have conjectured life to be something not dependent on structure, Mr Hunter was the first who deduced the opinion, as a legitimate consequence of legitimate facts, that life actually constructed the very means by which it carried on its various processes, and that it could operate in semifluid and even fluid substances. His intelligent mind further perceived that no system of physiology could be perfect that did not equally explain the morbid as well as the healthy actions of life. I may say, that he discovered a vital principle in physiology active in producing correct pathology: therefore he appears to me as a new character in our profession; and briefly to express his peculiar merit, I may call him the first and great physionosologist or expositor of the nature of disease.

Haller was a physician, Hunter a surgeon, both were anatomists and physiologists, both therefore equally qualified, as far as their knowledge of the animal economy extended, to discern the nature and mode of cure of the diseases in either department of medical science; yet, doubtless,

each most competent to decide upon the best means for effecting the latter purpose in that to which he had been educated, and his attention chiefly directed. Medicine is one and indivisible : it must be learned as a whole, for no part can be understood, if studied separately. The physician must understand surgery, and the surgeon the medical treatment of diseases. Indeed, it is from the evidence afforded by external diseases, that we are enabled to judge of the nature and progress of those that are internal ; which appeared so clearly to Boerhaave, that though his object was to teach his pupils the practice of medicine, he began by teaching them surgery.

Yet as medical science is so very extensive, and such accurate knowledge of its various subjects is required, the division of it into two principal departments, which custom has established, may be continued with great propriety and advantage. So much knowledge and talent is requisite in the division of surgery, for the correct re-adjustment of parts which have been severed and separated by violence ; for ensuring their unvarying motionless position, so essential to their tranquillity and re-union ; for suggesting and applying suitable means to soothe or correct the morbid actions of susceptible surfaces ; for discriminating the great variety of external local diseases ; and for performing the various and complicated operations of surgery ; that it requires the whole time and ability of any individual to attain even moderate perfection in this department of medical science. Whilst the no less extensive and important task of unravelling the intricacies of the symptoms produced by internal diseases, so as to trace them to their several sources, and consequently to decide upon their proper treatment; and of modifying the remedies employed, so as to adapt them to the varieties of circumstances and constitutions ;

equally demands the concentrated observation and reflection of the physician. Indeed the division of medicine into two principal departments, which custom has established, seems also to have received the fullest sanction of experience; and if we were not to acquiesce in it, we should subvert the institutions of society, and throw the whole profession into confusion. So much, also, is to be known and done in either department, that if we invade each other's province, we must neglect properly to cultivate and improve our own.

There are those who think that a still further subdivision of the subjects of medicine might lead to a more perfect knowledge of them. Yet the ultimate structure of all parts of the body being the same, their diseases must be similar, and treated upon the same general principles. If also, to investigate and understand any subject in nature, art, or science, a great deal of collateral knowledge be required, which serves like light shining from various points, to illuminate the object of our attention; when we examine particular diseases by the lights emanating from others, here such lights will indeed be found to be most apposite and illustrative. It is by comparing the nature and treatment of diseases with one another, that we improve our knowledge and practice with respect to those of particular organs, or portions of the body. If, however, after an enlarged education, if after knowing the whole, our observations were exclusively directed to a part, it is probable that increase of knowledge might result from such concentration of attention. Yet those, in general, who study the diseases of particular organs or portions of the body, think that they may save themselves the trouble of more extensive research, and thus their views become as circumscribed as the objects of their attention.

It is both evident to reason, and manifested by the history of medical science, or by experience, that it can only be attained and improved in one way. We must understand structure and function, and the changes produced in each by disorder and disease. There is no short cut, nor "royal road," to the attainment of medical knowledge. The path which we have to pursue is long, difficult, and unsafe. In our progress, we must frequently take up our abode with death and corruption ; we must adopt loathsome diseases for our familiar associates, or we shall never be thoroughly acquainted with their nature and dispositions ; we must risk, nay even injure, our own health in order to be able to preserve or restore that of others. Yet if we do this, our profession will be held in the highest respect ; not as in ancient times, merely on account of the beneficence of its object, but because it will be further perceived, that the means are adequate to its accomplishment.

If, however, we are disposed thus to labour for the public good, some concession, co-operation, and encouragement on the part of the public, may be by us reasonably expected. Anatomical knowledge is the only foundation on which the structure of medical science can be built. Without this, we should but increase the sufferings of those afflicted with diseases, and endanger their lives. Opportunities of dissection should therefore be afforded to us, The bodies of persons dying in the hospitals abroad are given to the surgeons for dissection, and even with the acquiescence of the public. In other countries it is considered, that those who have been supported by the public, when unable to support themselves, die in its debt, and that their remains may therefore, with justice, be converted to the public use. In England, however, the indigent who suffer from illness and injury are supported and relieved chiefly

by the liberality of that benevolence which is so creditable to our national character ; and much as I wish for the promotion of medical knowledge, I should be sorry if the bodies of the poor were to be considered as public property without reserve in our own country. For better would it seem to me, that medical science should cease, and our bodily sufferings continue, than that the natural rights and best feelings of humanity should not be equally respected in all classes of society ; or that merely because persons are poor, they should be prevented from paying the last tribute of respect and regard to their departed relatives by attending their remains to the grave. Yet if the directors of hospitals, poor-houses, and prisons, were to establish it as a regulation, that the body of any person dying in those institutions, unclaimable by immediate relatives, should be given to the surgeon of the establishment for dissection, upon his signing an obligation so to dispose of it, as to give no offence to decency or humanity, I am convinced, that it would greatly tend to the increase of anatomical knowledge amongst the members of our profession in general, and consequently to the public good. Or indeed it might be established as a law, that the body of any person of whatsoever rank or fortune, unclaimable by immediate relatives, should be subjected to dissection ; and thus a great public good might be obtained, without any infringement on the equality of rights. Other and better expedients may indeed be devised ; and the subject is so important as to deserve general consideration.

Yet, upon mentioning the foregoing suggestions to various persons, I have been uniformly answered, that the public would never consent to such regulations ; for their effect would be, to deny the body the rite of Christian burial. But that the funeral service availeth not to the dead

is made manifest, even by that sublime ritual itself, which places before our view the valueless nature of the dead body by the most emphatic language. We therefore commit the body to the ground; earth to earth, ashes to ashes, dust to dust. That is to say, confident it must, according to the laws of nature, resolve itself into other forms, and become again an undistinguished part of the common constituent matter of the universe. Religion also "doth teach us for to render the deeds of mercy" and benevolence to those that want them, which deeds cannot be properly administered to such as suffer from illness or injury, unless in consequence of our obtaining an accurate knowledge of the structure of the human body.

There is also another point on which some concession on the part of the public is required for the promotion of medical knowledge. We are sometimes called upon to examine the bodies of the dead, in hopes of our being able to discover the cause of death for the satisfaction of their relatives, when such examination affords us no additional knowledge; for we see only the common appearances of disease with which we are familiarly acquainted: and yet we are frequently denied the same opportunity when we most earnestly solicit it, from the belief that we shall obtain important information by the investigation. Wishing to exhibit the effect of such refusal by some striking instance, I am tempted to relate an anecdote of Mr. Hunter, even though some may not think it to his credit. Mr. Hunter, who was never afraid of speaking his mind, had attended, in concert with another surgeon, a fatal case of disease in the child of a gentleman of opulence and worldly consequence. Mr. Hunter had been much interested by the case: he had considered it, as he was wont to do, deliberately and intently; and believing that much good might

result from ascertaining its nature, he had requested permission to examine the body, which was refused. He went to the house of the father, in company with the other surgeon, and tried all his art of rhetoric and persuasion, but in vain. When he became convinced that his object was unattainable, he was standing, said the relator of this anecdote, with his back to the fire, and he put his hands into his pockets. "I saw," continued the narrator, "by his countenance, that a storm was brewing in his mind." Mr. Hunter, however, gravely and calmly addressed the master of the house in the following manner: "Then, Sir, you will not permit the examination to be made."—"It is impossible," was the absurd reply. "Then, Sir," said Mr. Hunter, "I heartily hope, that yourself, and all your family, nay, all your friends, may die of the same disease, and that no one may be able to afford any assistance;" and so saying, he departed. Such a wish could never, I am convinced, have originated in his benevolent mind; as indeed is manifested by the very terms of it, which involve the innocent with the offending. Temporary irritation alone incited him to adopt this mode of expressing his strong conviction of what it became equally his duty to perform, and theirs to permit, for the attainment of knowledge, the most important to humanity. It is easy to perceive the causes of reluctance in general to such examinations. Persons question if their departed relative would have approved of it; they think it disrespectful, or that some unnecessary or indecent exposure of the body may take place; they suspect that we perform these acts with levity, or in a frame of mind discordant with their present feelings. It is for us to convince them by our manners and conduct, that we only seek for knowledge; and that we do so with dispositions

suitable to the solemnity of the occasion, and in sympathy with their feelings, and distress. Having thus told you, gentlemen, what appears to me chiefly necessary to be done, on our part and on that of the public, for the promotion of medical science, I take the liberty of further observing, that to some it might seem strange that persons in general do not take more concern about it, when it is manifestly of vital importance to them. This College, sensible of the great injury which the public sustains from the ignorance and fraud of empirics, petitioned parliament to grant it a power of control, by process of law, over those who set up to practise surgery, without having undergone an examination, to testify their education or ability: a power not likely to be exercised except in cases of flagrant offence; a power also determinable in its degree and effect by impartial judges, by the judges of the land. To some of the members of the House of Commons, however, this petition appeared like an attempt to procure a monopoly of surgical practice, and it was rejected. The College still persevering in its endeavour to prevent a great public evil, and desirous of freeing itself from all imputation of being actuated by interested motives, brought forward a new bill, entirely of a public nature, which was also rejected; so that, in these transactions, the College may be said to have lost every thing but its honour.

The whole history of medical science affords no instance of its promotion by any individual, at all comparable with that produced by the man whose natal day we are now met to commemorate. It is indeed a surprising example of the scarcely expected improvement which may be effected by the industry of an individual when exerted in a right direction, and aided by that intelligence which reviews ac-

cumulated facts, compares, discriminates, combines and arranges them; whilst it also draws cautious inferences from them, and suggests new subjects of enquiry, and new modes of research.

Of the genius, reflection, talents, and industry of John Hunter I have already spoken; but to commemorate him on the present occasion, I will tell you what I observed relative to the peculiar and distinguishing characters of his mind. Surely the lineaments of the mind must be more interesting than the form and features of the body. It is the character and conduct of the former which chiefly excite our interest respecting the latter; and if any one were desirous of knowing what manner of man Mr. Hunter was, I could not wish to refer them to a better resemblance of him, than that drawn by Sir Joshua Reynolds. Perhaps my knowledge of Mr. Hunter's character may aid my imagination; yet when I look on that picture, I feel as if I saw before me an old man, a shrewd man, aye, and a benevolent man too, in the act and attitude of habitual thought.

Sir Everard Home, who had great opportunities of knowing Mr. Hunter, has represented him as an honest, independent, perfectly candid, and most industrious man, indifferent about money, and much attached to science. Now though I believe this sketch to be perfectly correct, yet there were finer traits of character requiring to be depicted ere I should recognize the intellectual resemblance of John Hunter. Those who make the study of nature, and of science, or the attainment of moral good, the ultimate object of their endeavours, are candid, disinterested, benevolent, and humble minded. They openly avow their designs, solicit the assistance of others, and assist them in return; they note the slow degrees by which they advance in knowledge, their frequent failures, and the imperfection of their own pow-

ers ; they also compare the aggregate of their advances with the illimitable nature of those objects to which they have merely approximated. Whilst those who make power, wealth, or any species of notoriety, the object of their ambition, are secret, selfish, suspicious, cunning, and conceited. In general, they are ashamed or afraid of avowing their designs, and therefore obliged to enveigle the co-operation of others. They suspect that they may be counteracted ; and in proportion as they attain their ends, they feel elated with their own abilities, from the belief that no one but themselves could have atchieved them in the like manner and degree. The choice of our objects manifests the natural dispositions of our minds, which are confirmed and augmented in their pursuit.

Mr. Hunter was an excellent example of the former class of men. My desire to know why a man of such intellectual powers did not display them in a manner more advantageous to his reputation, first induced me to propose to him questions, merely in order to learn how he would answer them : yet this seeming desire of information on my part, acting on his benevolent mind, induced him to pay me much more attention than I had been accustomed to receive from others. He invited me to come to his house, to sit and converse with him. I now regret that I profited so little by the opportunities he offered me ; but I was at that time ignorant of the value of the information which I might have derived from him. That benevolence was a predominant sentiment of Mr. Hunter's mind may be inferred from his fondness for animals, his aversion to operations, and from the zeal with which he assisted every poor man of merit. Upon mentioning my conviction on this point to a surgeon who knew him intimately, he replied, " I am sure I have reason to think so. for I was ill, and he kindly and

diligently attended me: nay, he brought those of his medical friends to visit me in whose judgment he placed most confidence. My illness being, however, tedious, I was at length obliged to go into the country for the recovery of my health. Mr. Hunter called on me before my departure, and said, 'I have been thinking, that you might want a little money; if so, I can procure you 200l.; though, in general, I am the most unlikely person in this town to have money at command.' I thanked him," continued the surgeon, "but told him, I had been more provident than might perhaps have been expected, therefore I did not want money. On my return to town and re-establishment in business, which did not take place for a considerable time, I took an opportunity of expressing to Mr. Hunter, my continued sense of gratitude for his kindness in attending me, and for his offer of pecuniary assistance. 'Hah,' said he, 'I offer you money! that is droll, indeed; for I am the last person in this town to have money at command. I have entirely forgotten it. But of this I am assured, that what I offered, I meant to perform.'" Now, Gentlemen, I must restrict myself to a single instance in proof of the several propositions that I wish to substantiate, instead of numbers which I could adduce.

The candour of Mr. Hunter's character was evident in all his actions. He readily told all he knew or thought upon every subject; and was pleased in assisting others to acquire knowledge. It is indeed highly improbable, that a wise and good man should be otherwise than candid. For wisdom teaches him not to form opinions but on sufficient grounds and consideration; and these he would freely reveal, being equally desirous that they should be corrected, if wrong, and acknowledged, if right. Sir Everard Home has said, that Mr. Hunter's disposition was "free from re-

serve, even to a fault; for it sometimes made him appear harsh." Yet harshness, I am convinced, could never have proceeded from a mind attuned like that of John Hunter. I do not wish to deny or conceal, that occasionally the candour and susceptibility of his character might incite him to express his vexation and indignation with a degree of energy and openness that would give offence, and fail to produce the good resulting from mild remonstrance and explanation. Yet for this occasional want of temper, many and perfectly exculpatory causes may be stated.

Mr. Hunter's life was one of continual exertion, perplexity, and irritation. He was constantly engaged in the search and consideration of new facts. "My mind," said he to me, "is like a bee-hive;" and the simile struck me, on account of its correctness. For, in the midst of buz and apparent confusion, there was great order; regularity of structure; and abundant food, collected with incessant industry, from the choicest stores of nature.

It will be generally admitted, that the want of money would be an adequate cause of perplexity. Yet to Mr. Hunter, the very means by which the necessary supplies were to be procured proved sources of irritation. The search for money led him from the more congenial pursuit of knowledge. It broke into his arrangements; distracted his attention; and we find him complaining of this, like one who had felt it sorely.

Those who far precede others must necessarily remain alone; and their actions often appear unaccountable, nay even extravagant, to their distant followers; who know not the causes that give rise to them, nor the effects which they are designed to produce. In such a situation stood Mr. Hunter with relation to his contemporaries. It was a comfortless precedence, for it deprived him of sympathy and

social co-operation; and he felt that his labours and merits were not known, or fairly estimated.

None of these causes of irritation, however, in general disturbed the patience and good-humour of John Hunter, who found ample consolation, in thinking of what he had already done, and might still do, for the attainment of knowledge, the most important to humanity.

That Mr. Hunter had a very susceptible mind can scarcely be doubted. Sir Everard Home informs us, that he would weep at the recital of a generous action; and when shame cannot prevent us from doing this, neither will fear deter us from expressing our indignation at one of an opposite nature. We are apt to misjudge one another. Few have the penetration of Sterne, and are capable of discerning how circumstances, trivial in themselves, by links of connection with the finer feelings of the mind, may produce the extremes of pain or pleasure. Mr. Hunter had befriended and professionally attended the family of a poor man of much talent as a painter. He afterwards requested him to paint the head of an animal. When the portrait came home, Mr. Hunter was delighted with it; but when he found it was accompanied with a bill to a much greater amount than would have been charged by any other artist, he was highly incensed. Can it be supposed, that it was the necessity for paying so much money, that made Mr. Hunter angry? No; it was ingratitude, which worse than the viper's fang had wounded him, and produced this paroxysm of irritation.

As a contrast, however, to that occasional want of temper which some may consider as a fault in the character of Mr. Hunter, I may mention that his habits of investigation, and his slowness in communicating his own opinions, had given him an admirable degree of patience and persever-

ance in accomplishing whatever he undertook, and this was conspicuous even in the common practice of his profession. In one of the cases which he has published, he says,—"After about an hour's conversation with the patient, I made out a few simple facts." If pressed for time, he was often known to say, "I cannot tell at present what to recommend: I must think of it." For to Mr. Hunter almost every case was a study, and so indeed it must be to all those who practise their profession as a science. I will here relate one out of many instances that I could adduce of the pains which he took, from benevolent motives, to convince persons of what seemed to him essential to their welfare. A strong ruddy-faced farmer had a disease, which induced Mr. Hunter to enjoin a total abstinence from fermented liquors. "Sir," said the farmer, "I assure you that I am a very temperate man; I scarcely ever exceed three pints of ale in the day, and I never touch spirits." "But," said Mr. Hunter, "you must now drink nothing except water." "Sir," said the farmer, "that is impossible, for I cannot relinquish my employment; and you know, Sir, it is impossible to work without some support." Mr. Hunter perceiving that his patient was not likely to be readily convinced, enquired how many acres of land he cultivated, and what number of them was arable? He next asked, how many horses were kept upon the farm? and then boldly asserted, that they were too few in number for the quantity of land. The farmer maintained that they were sufficient, but was at length brought to confess, that they were worked hard. Allow me then, said Mr. Hunter, to enquire what it is that you give them to drink?—You see, gentlemen, that John Hunter, like Socrates, was well aware of the advantage of that mode of conducting an ar-

gument, by which the disputant is made to convince himself: though, I dare say, that he had never heard of its being employed by that philosopher. I have heard many patients speak of Mr. Hunter, and none without a fond remembrance of his kindness and attention. I have indeed been told, even by them, that he was sometimes in a passion when he was vexed; which, I think, ought to have been excused, as it was the natural and almost inevitable consequence of the best dispositions of the human mind. This short-lived turbulence should, indeed, be treated with pity and indulgence, when it is the legitimate offspring of sensibility and integrity.*

That Mr. Hunter was an humble-minded man, may be inferred from the caution and diffidence which is a striking characteristic of all his scientific investigations. He has, doubtless suppressed the communication of facts and experiments, manifesting a degree of labour and intelligence, sufficient to give reputation to persons of ordinary character. Though he endeavoured to investigate the nature of diseases in order to understand their treatment; yet he never deviated from established rules of practice without cogent reasons for his conduct. This I mention from being aware, that if we presume on our knowledge of the nature and treatment of diseases, we may, like the ancient dogmatists, do mischief. Mr. Hunter's constant saying was, "we are but beginning to learn our profession." That he was conscious of the importance of his investigations, that he saw by anticipation the good effects that might result from them, cannot be doubted; yet I have heard him declare, and I know he was accustomed to say, that he was not conscious of possessing any peculiar

* An honest warmth, child of integrity.

SHAKSPEARE.

talent, and that if he had promoted professional knowledge, it seemed to him chiefly to have arisen from his disposition to distrust opinions and to examine every subject for himself.

Mr. Hunter was, moreover, a man of very considerable humour. His views of subjects in general were quick and peculiar, and when so disposed he could place them in very ludicrous points of view. I have known him to exert his talents in this way in a very entertaining manner; but though I could produce abundant proofs of my present proposition, they would be unsuitable to the gravity proper to be maintained on this occasion. I have heard some express their wonder that very sensible men have sometimes condescended to appear foolish; yet it ought not to excite surprise, for it only shows the activity of their minds which sometimes relieve themselves from the uniformity of thoughtful exertion by sportive and irregular actions. They find it "*dulce desipere*," and have no fear, as others might have, to indulge themselves in this propensity. Thus strong and healthy people, after the labour of the day, derive recreation from the continued efforts of a lively dance, or some agile sport.

There is, however, one subject evincing Mr. Hunter's possession of the kind of talents I am now alluding to, to which I may advert on the present occasion, because it is connected with our professional concerns. Yet here also I must restrict myself to one instance selected from a considerable number, and I doubt if it be the best for my purpose. Mr. Hunter's sagacity led him speedily to discover and detect those impositions which some persons are induced to practise on us. A patient in the hospital feigned to be afflicted with catalepsy, in which disorder, it is said, a person loses all consciousness and volition, yet remains in

the very attitude in which he was suddenly seized with this temporary suspension of the intellectual functions. Mr. Hunter began to comment before the surrounding students on the strangeness of the latter circumstance, and as the man stood with his hand a little extended and elevated, he said, you see, gentlemen, that the hand is supported, merely in consequence of the muscles persevering in that action to which volition had excited them prior to the cataleptic seizure. I wonder, continued he, what additional weight they would support, and so saying, he slipped the noose of a cord round the wrist, and hung to the other end a small weight, which produced no alteration in the position of the hand. Then, after a short time, with a pair of scissors he imperceptibly snipped the cord. The weight fell to the ground, and the hand was as suddenly raised in the air by the increased effort which volition had excited for the support of the additional weight. Thus was it manifested that the man possessed both consciousness and volition, and the impostor stood revealed.

Having thus told you, gentlemen, what appeared to me as distinguishing traits in the character of the man whom I have already eulogized for having made surgery a science; for having the penetration to discern the direct path of knowledge, and the talents and industry to remove all the obstacles which concealed or impeded its entrance; for having conducted us to a certain extent so prosperously, that it must be our own fault indeed if we do not advance to more perfect discoveries of still obscure and remote objects :—I may then conclude, that so long as surgeons feel an interest in the improvement and reputation of their profession, or a value for their own character as men of science, so long will the name of John Hunter be remembered by them with gratitude and respect: or in Virgil's beautiful and often quoted language I may say,

Semper honos, nomenque suum laudesque manebunt.

POSTSCRIPT.

This Oration comprehends the remainder of what I was desirous of saying with respect to the labours, opinions, and character of Mr. Hunter. It has been printed in this form, that it may be bound up with my lectures at the College, which are designed to exhibit Mr. Hunter's opinions of life and its functions in the states of health and disease. Yet, as my conduct in this publication has been lately aspersed by Mr. Lawrence, in a point which I should be always most eager to defend, though, I trust, it is one of the least vulnerable parts of my character, that of honesty and fair dealing; I feel under the necessity of adding a few words, and, for the first time in my life, of speaking of him, before the Public, in other terms than those of commendation. As an introduction to his lectures, just published, he has placed what he has chosen to call an answer to some charges which, he says, I have made against him. But as neither my own, nor Mr. Lawrence's meaning or feelings can be understood by others without previous information, I must therefore mention, that from a very early period of his professional studies, he was accustomed to decry and scoff at what I taught as the opinions of Mr. Hunter respecting life and its functions. Yet as I could never find that he had any good reasons for this conduct, I continued to teach them in the midst of the controversy and derision of those students who had become his proselytes. As a teacher of young men I felt particularly anxious that they should possess just, benevolent, and honourable sentiments, and therefore was I interested in maintaining those opinions respecting life, which seem to warrant the further opinion of the distinct and independent nature of mind;

whilst more particularly did I feel bound to maintain them, when the contrary assertions were unsupported by facts or arguments. *

* I have admitted the assertion that the brain is as much an organ of sensation and thought. as the liver and stomach are organs for the secretion of bile and gastric fluid: but the physiological question in dispute is, how do these organs accomplish their respective functions? The opinion that the functions of life are the result of subtile principles commixed with the visible fabric of living beings, will, I believe, be soon generally admitted; and I contend that the liver and stomach prepare their respective fluids in consequence of their vital principles, and not merely as a result of their organization. Yet I cannot suppose that the brain produces our sensations and thoughts in the same manner. Indeed, it is impossible to suppose, as a poetical writer has humorously suggested with regard to Milton,

That he from the glands of his brain
Secreted his Paradise Lost.

Also, from the equal absurdity of supposing that the soft medullary fibres of the brain feel and think, the common sense of mankind will for ever revolt. As we cannot either suppose sensation to result from any motion or arrangement of insensible atoms, as we have reason to believe that all the vital processes are carried on in many instances without sensation, and that when it is added that its district is limited to the brain, so we seem compelled to admit that life influences, through the means of its actions and organization, something having the properties of perception, &c. is acted on by it in return. As Mr. Lawrence's late publication contains but a repetition of assertions which I have in general objected to, as he continues to harp upon words without attending to thoughts, and without even seeming to have noticed what I have said with relation to the subjects under discussion, I have nothing further to add to the foregoing lectures, except upon one point on which he has a little enlarged. He maintains the assertion that the mind, like the body, is imbecile in youth as well as decrepit in age. Now that the processes and evidences of mind should be enfeebled and disturbed by corresponding states of the nervous system would be naturally expected; but that, under other circumstances, any evident difference in the intellectual functions is observable, is an assertion which will, I believe, on examination, be found to be incorrect.

Children are highly susceptible, and prone to continual action. They are vividly affected by every impression, most of which also produce on them an effect which novelty gives to subjects even in adult life. Youth is the season for acquiring knowledge; reflection would but retard its attainment, and would be unavailing from deficiency of facts and experience. That the mind is often wayward and irrational in youth as well as in age, is apparent; but that it exhibits as powerful intellect when excited and when it possesses adequate means for its exertion in childhood, as at any period of life, must, I believe, be acknowledged on a full examination of the subject; which has been admirably displayed by the writings of Miss Edgeworth. That children also possess the more energetic qualities of mind, those which chiefly characterize its distinct and superior nature, in as great a degree as at any period of life, will not, I think, be denied by any who has carefully attended to their conduct. Yet surgeons possess particular opportunities of making such remarks, and the communica-

When I had the honour of being appointed Professor of Anatomy and Surgery to the Royal College of Surgeons, I began my lectures, for reasons which I have fully explained in them, with an account of what I believed were Mr. Hunter's opinions respecting life; and to me, it would have seemed wise in the opposite party to have suffered these lectures gradually to have sunk into oblivion. On the contrary, however, the opinions I had promulgated were said to be absurd and untenable, and even ridiculed by a writer in the Edinburgh Review. When, afterwards, Mr. Lawrence began to lecture at the College, he adopted the same line of conduct; nor were his hostile and taunting expressions confined, as he says, to his first lectures. The theme of his exultation and raillery was introduced to enliven many others. In the published lectures will be found a varnished character of myself, in which, however, I clearly distinguish one truth, that of having always acted as his zealous friend; and surely the recollection of such conduct would have induced a generous mind to have gloss-

tion of instances, which are not to them very uncommon, may be useful in the general consideration of this subject. When I first attended St. Bartholomew's Hospital, one of the old surgeons was a most benevolent man, whom all the patients loved. There was a little boy of five years old, whom this surgeon was to cut for the stone. The boy complained loudly, and struggled much, during the introduction of an instrument, which was but a preparatory step to the operation. The old man patted the child on the cheek and said, "You know, my good little boy, that I would not hurt you if I could help it."—"I know it, Sir," said the child, "and I will cry no more." He underwent a severe and tedious operation. His teeth were clinched, his lips were working, yet no sound was heard.—A few weeks ago, an emaciated and very sickly child of seven years old was sent into the hospital to have a diseased knee removed. The case was indeed hopeless. When the little patient had become familiar with his new abode and attendants, and certain circumstances known with respect to his health which it was proper should be ascertained, I said to the child, for I knew not whether he had been apprized of his doom, "I suppose, my little fellow, that you would not mind having this knee removed. which has pained you so much, and made you so very ill."—"Oh, no," replied he, "for mammy has told me that I ought." At the time of the operation he manifested neither hesitation nor opposition, nor did the voice of complaint issue from his lips.

ed over also what it might have considered as my defects. When I heard those lectures, I told Mr. Lawrence, (for I had always spoken my sentiments to him with candor,) that he seemed to me to have done a very foolish thing in attacking my opinions in a place where I felt obliged to defend them; and added, even the consideration of the impropriety of two professors in the same establishment differing with one another, ought to have restrained him. In my next lectures, which were designed more fully to explain Mr. Hunter's opinions, by showing the manner in which he had deduced them from the consideration of all the vital processes, I carefully concealed Mr. Lawrence from public view, by arguing against a party, by contending against opinions and not against persons: nor did I ever mention his name or words but in order to induce others to suppose that we did not differ in sentiments. The sentence to which I allude ran thus: "Comparative anatomy, also, as my brother Professor very judiciously observed in his introductory lectures, furnishes abundant arguments to the natural theologian, by the evidences it affords of design, and of the adaptation of means to ends." When, however, I perceived that he was hurt by these lectures, I assured him that I did not mean personally to allude to him, and after consideration added, neither could I conceive how he could suppose that I did, unless indeed by identifying himself with those writers from whose works he had copied. I offered also to expunge the sentence above quoted. He replied, "No; I do not object to it: you may do as you please." I therefore inserted the words without naming the author. Is it then generous in Mr. Lawrence to say, "that the quotation of his own words rendered it impossible for him to shield himself under the pretext of uncertainty," or to suggest that my lectures (which were excited as

an act of self-defence) were meant chiefly as an attack upon his conduct and character? Is it becoming in Mr. Lawrence to hold me forth to public view as one blinded by national prejudice to the merits of persons of other countries? On the contrary, I consider all mankind as brethren, yet all brothers have not the same sentiments and dispositions. The sons of science may more particularly be regarded as of one family, and their residence in different countries cannot annul their fraternity. Yet surely it is allowable in me to suppose that the notions of our brother physiologists in France may have been influenced by the state of public opinion in that country. I am aware that what I have termed modern scepticism arose in a great degree from good feelings; from an abhorrence of the dreadful consequences of superstition and bigotry, and of those of tyrannical restriction and oppression. Yet in recoiling from one kind of error, the party seem to me to have run into an opposite one, and to have equally deviated from the mid-way path, which is trodden only by the unprejudiced and considerate. With respect to the subject of nationality, however, I wish to submit a sentence, which I remember to have heard in Mr. Coleridge's lectures, to Mr. Lawrence's consideration. There can be no sincere cosmopolitan, who is not also a patriot. Is it becoming likewise in Mr. Lawrence to point out what he considers as the weak parts of my lectures to general observation? Fortunately for me, indeed, he is not to be my judge; for he is strongly prejudiced, and evidently angry: the members of our profession in general are to determine the value of my humble endeavours to promote our professional knowledge and character, and in their decision I am ready respectfully to acquiesce.

REFLECTIONS

ON

GALL AND SPURZHEIM'S

SYSTEM

OF

PHYSIOGNOMY AND PHRENOLOGY.

BY

JOHN ABERNETHY, F.R.S.
SURGEON TO ST. BARTHOLOMEW'S AND CHRIST'S HOSPITALS.

ADVERTISEMENT.

Knowing that the following Address does not contain any thing *new*, the Author would not have published it, if he had not considered it to be a necessasy addition to those views of the diversified effects produced by vital actions, which he has exhibited in the Physiological Lectures addressed to the College of Surgeons.

AN ADDRESS, &c.

Gentlemen,

THOSE sentiments and opinions which it is necessary man should entertain for his proper conduct in life, seem to be so readily acquired from the general contemplation of nature, and the operations of our own minds, that many have believed them to be innate or intuitive. They appear also to be more and more confirmed by the researches of science and the progressive accumulation of knowledge. Surely no man ever deduced opinions from a more accurate, minute, and extensive examination of all the vital phænomena, in every variety of living being, than Mr. Hunter; and none ever displayed more philosophical caution in forming conclusions; yet his notions of life were those which common sense dictates, and which were also entertained by the most intellectual characters in remote ages: this I have already endeavoured to show in lectures addressed to the members of the college.

Convinced of the truth and importance of Mr. Hunter's opinions relative to the Nature of Life, I am now desirous of enquiring, how any portion of physiological knowledge obtained since his time may have affected his sentiments in general, and particularly with respect to the functions of the most important organ in the animal economy of the human race. That the brain of man, and of animals similarly con-

stituted, is a great emporium of nervous energy, that it sympathises with every part of the body, and bestows or excites animation and energy throughout the whole, has not, I believe, been disputed; yet the experiments of Le Gallois, and the observations of Gall and Spurzheim, have rendered it highly probable that the brain of animals ought to be regarded chiefly as the organization by which their sentient principle becomes possessed of a great variety of perceptions, faculties, and disposition to various kinds of action. To the consideration of this subject, I am desirous of exciting the attention of members of the medical profession, because their opinions must have great influence with the public upon topics connected with their peculiar studies, and because there is no subject on which individual and general welfare so strongly demands that every one should think clearly and considerately.

When Dr. Spurzheim, impelled by laudable enthusiasm, and the belief that he could communicate new and important information relative to the nature of man, and the means of improving his mental faculties and moral character, came to this country, he met with but very few who would give the subject he proposed to them that patient attention and consideration which are necessary for its clear comprehension, or that continued examination which alone can enable any one to form his own opinion respecting the merits or truth of his system. General attention, therefore, to Gall and Spurzheim's opinions seemed to have subsided in this country, when a most able and eloquent advocate came forward in their behalf, asserting the superiority and excellence of their system of phrenology, and his own conviction of the correctness of their proposed mode of physiognomical enquiry. In his judgment, re-

specting the former subject, I readily concur, but am incompetent to give an opinion upon the latter; for when I first heard Dr. Spurzheim's lectures, I candidly told him, that though I admitted his opinions might be true, yet I would never enquire whether they were so or not; because, I believed the proposed mode of judging of one another to be unjust, and likely to be frequently productive of erroneous and injurious conclusions.

But notwithstanding this resolution, I did not absolutely shut my eyes against those facts which obtruded themselves before my view; and I acknowledge that I have been often struck with the coincidence between the character and talents of persons and the form of their heads, which was such as is said to be indicative of their peculiar dispositions and abilities. The intelligence and candour of Dr. Spurzheim, however, induced him to say to me, that it matters not how many coincidences we may observe; one contradictory fact must disprove them all, with respect to the asserted locality of any organ; and such contradictory facts have, as I believe, also presented themselves before me.

I am aware how exceedingly difficult it must be to decide on this point; for though organs may be large, yet they may be more extended and less prominent than usual; though small, they may be active from constitutional vivacity, education, and habitual employment; and though large and prominent, they may be inactive from disuse and controul. Surely the foregoing considerations, together with the numerous and indisputable instances which we possess, proving that the character and conduct of persons* depend

* In my opinion, Miss Edgeworth has done the public a most important service by showing, even to children, (in the Parent's Assistant) that

very much upon education, habit, and association, ought to make us exceedingly cautious how we judge of others merely from the form of their heads.

I anticipate nothing but mischief from Gall and Spurzheim's Physiognomy or Cranioscopy* becoming generally known and accredited. Suppose a man to have large protuberances on that part of the head, where they are said to indicate excess of cautiousness; suppose him apprized that such excess tends to produce melancholy musings and irrational apprehensions, which may hold the mind spell-bound and appalled, till suicide is welcomed as the only means of escape from seemingly insupportable gloom and horrors. Suppose him with this information seized with a fit of temporary despondency; will he now strive to rouse his mind to active exertion and employ it on other subjects? —will he not rather think the effort useless and be inclined to submit to his doom, from the belief that it is the result of unalterable organization? Or, suppose a man to have large knobs on his head which are said to indicate him to be a knave and a thief, can he expect assistance or confidence from any one? Must he not, as all of notoriously bad character do, consider himself to be an outcast

by perseverance difficulties may be surmounted, and abilities acquired, or talents improved; also how by degrees good habits are formed, and a good character established. She has done this in so inviting a manner, and displayed so clearly and strongly the excellence of virtue and good conduct, that I think it impossible for a child to read her book without resolving steadily to persevere in the path of active industry and moral rectitude, whatever temporary difficulties may oppose its progress.

*Though the former term cannot etymologically be objeted to, yet the latter more clearly defines their object, and distinguishes it from what is usually meant by physiognomy

from society, having no means of serving himself but those with which nature has endowed him, and which, in the instance and under the circumstances referred to, may indeed be those of fraud and cunning.

If a man, like Dr. Spurzheim, who had made the motives of human actions a particular study, possessing also great intellectual powers combined with benevolence and caution in decision, should from the survey of another's head suppose that he had discovered his character, he would next observe his conduct with particular attention, in order to determine how far his cranioscopical inferences were confirmed by facts. Thus would his speculations only lead to an enquiry which of itself alone forms the fairest and surest criterion that we can possess of judging of one another. But if an unbenevolent and inconsiderate man, who had never studied human nature, were at once to decide from the form of the head, and suspect or believe all those who happen to be broad across the temples of being covetous or crafty, he would surely injuriously mistake the character of many persons.

It is said, that this system of physiognomy will assist us in the education of children. Yet their actions are sufficiently, and I think more clearly, declaratory than the form of their heads of their sentiments, dispositions, and talents. Those who have a taste for music or drawing, manifest their fondness for those arts by their earnest attention to the subject of them, and their abilities by the imitations they attempt of whatever has particularly pleased them.

It is asserted that this system of Physiognomy may assist us in the cure of insanity. But how that dreadful malady

is to be cured except by the usual medical and moral management I am not able to comprehend. The object of the former is to tranquillize or remove that state of nervous irritation or disease which may have led to the establishment of insane ideas; whilst that of the latter is to weaken and annul these irrational ideas by so occupying the mind as to prevent their recurrence. Nor, in my opinion, could the medical profession wish for a better illustration of what may be termed the moral treatment of insanity than that which Doctor Johnson has laid before the public in his Rasselas, shewing by what means the Prince and his sister effected the cure of the insane astronomer.

The views which Drs. Gall and Spurzheim have taken of the nature of the dispositions and faculties of man and animals appear to me, however, both new and phylosophical, and these admit of being surveyed without any reference to organization or its supposed situation.* It is thus only that I submit them to you as well deserving your examination; for I think it will be acknowledged that they have drawn a correct portrait of human nature, whether they be right or wrong in their speculations concerning

* When the subject is thus examined, it may be questioned whether any peculiar merit is due to Gall and Spurzheim for the representation which they have given of it. As many learned men who have published on the same subject, have not represented it in the same manner; and as the speculations and progressive steps by which Dr. Gall was led to see the subject in the manner he has pourtrayed must be allowed to be peculiar to himself; I feel warranted in ascribing the phrenology, even when abstracted from the organology, to these ingenious and scientific men

certain protuberances which they have depicted. Believing that some, pleased with the phrenology, may overrate their physiognomy or cranioscopy, whilst others, from perceiving the uncertainty and ill-consequences of the latter, may be inclined to undervalue the former, I am induced for reasons already mentioned, to urge your attention to these subjects. From my deficiency in literary research, and my neglect of registering what I may have read, I am unable to trace the sources of my own opinions, yet as I proceed I shall candidly avow them, without presuming to suppose that others have not thought in the same, or in a better manner, and to a greater extent.

First then, I admit, nay even admire the simple proposition, that man and animals resemble one another, in each possessing, in various degrees, instinctive and urgent propensities to perform certain actions. These propensities, though they operate without the influence of reason, are however in man regulated by that power. Yet with respect to the results produced by their operation, it may be affirmed that animals as far surpass mankind, as man by his rational faculties and sentiments becomes in other respects superior to them.

OF THE PROPENSITY FOR CONSTRUCTION.

How very curious is it, that at certain seasons of the year animals should be seized with a propensity to build nurseries for their young and storehouses and habitations for themselves, without foreknowledge that they may be wanted for future inhabitants, or at future seasons. Some birds begin to build before they procreate, and the sterile labouring bees in constructing a storehouse for their com-

munity, do not neglect to provide necessaries and accommodations for the young of the common-parent of the hive. How very curious also are the structures which many animals erect without previous plan or design, and in some instances without any communication with one another. How admirably suited also are these structures to exigencies unforeseen by the artificers. Some hornets build the exterior of their nests with agglutinated leaves, and the interior cells with the same materials, reduced to the state of paste or mortar, whilst the bees which build in hollow trees, requiring no protecting walls, merely build a comb with plates of wax resembling tiles, which are prepared and formed between layers constructed for this purpose on the surface of their bodies. This apparatus and its products have been exhibited by Mr. Hunter in his museum, and you know his very interesting paper on this subject which is published in the philosophical transactions. The greater number of animals, however, have no necessity nor propensity to build; so that this very curious instinct is also a very partial one.

Gall and Spurzheim assert that this propensity is the result of a peculiar organization in a portion of the brain, the exuberance of which is rendered evident even by the exterior form of the head. They say that some individuals of the human race have a strong propensity to construct things and an aptitude for such employment, whilst others have no disposition or talent of this kind. They assert that both in man and animals, those individuals who have this constructive propensity have also a corresponding form of head which is wanting in others who do not possess it. They make a similar assertion with respect to all the other instincts which we are to consider, but it will not be necessary for me to repeat it. Now here I may observe

upon the supposition of Gall and Spurzheim's views of these subjects being correct, that the occasional, perhaps annual recurrence of this propensity, renders it probable that it is not organization merely which creates it, but that it arises from temporary actions occurring in peculiarly organized parts; and the rare recurrence of this instinct shows how long such actions may be suspended so as to render organization of no effect.

Admitting that man, like animals, possesses in various degrees a natural propensity and talent for construction, yet no blind impulse regulates his labours; he constructs what his reason directs, or his fancy suggests; he forms previous plans or designs, and alters them till the whole seems to accord with his intentions; and yet none of his works is so unalterably perfect as are those produced by blind instinct operating according to the ordinances of overruling Intelligence.

OF PARENTAL AFFECTION AND ATTACHMENT.

No instinct is, in general, more strong than that which attaches the parent to its offspring, for it sometimes induces the former to perish in defence of the latter, which have no other protector. Yet this instinct is very variable, and sometimes even wanting in particular instances; occasionally, animals neglect their young, and leave them to perish; nay, sometimes they injure and destroy them. This instinct generally belongs to females, but the male also may possess it. All these facts are equally true with respect to the human race, in which this instinct evidently operates independently of reason; for though rational considerations may dictate and enforce maternal care, they can never produce maternal affection.

OF IMITATION.

Though there is something in the constitution of animals which causes the peculiarities of their actions, yet it is manifest that many have a propensity to imitate those of others, and it is probable that this propensity, together with the acquired habit of doing what has been repeatedly done, is a great source of conduct among animals of a gregarious nature. As man is an associating animal, he participates largely in this propensity, and there are some persons who possess the disposition and talent of imitation in so high a degree that they are led to hurt the feelings of others by offensive mimickry.

OF THE DISPOSITION TO COMBAT.

In most kinds of animals, the activity of the vital powers incident to early life, is exerted in running and striving in mock combats with one another; and thus do they acquire the art of self-defence, and of shunning danger. That some kinds of animals, and some individuals in particular, have a strong propensity to combat is evident, for they are known to fight when grievously mutilated, and even till they die. That man also possesses this kind of animal courage, this propensity to combat and contend, is well known to the English, for it forms a striking feature in their national character. The people actually seem fond of boxing, wrestling, and cudgel-playing, and become hardy and resolute by such practices.

OF THE PROPENSITY TO DESTROY.

That predacious animals have a strong propensity to destroy others, is evident; for when not impelled by want,

they injure, and kill them. This is chiefly seen in animals of the cat kind, though the lion, the most powerful of the tribe, is rarely known to commit unnecessary slaughter; and therefore does the rational animal, man, admire the character of this noble brute. That some men are even pleased with cruel sports and sights, and feel no compunctious visitings of nature in acts which excite horror in others, must, I believe, on examination, be admitted. It seems, therefore, allowable to suppose that man participates with brutes in possessing, in a greater or less degree, a propensity to injure or destroy that which he dislikes, or which his judgment deems necessary to be destroyed. If a man had that kindness of disposition which would induce him, when he had caught an insect that had long vexed and annoyed him, to put it out of the window, saying, "why should I harm thee, the world is wide enough both for thee and me," unbalanced by any opposite feeling, and uncontrolled by the power of reason, he would suffer his house to be overrun with vermin, and animals to multiply to the detriment of the general good, and the ultimate injury of those whom his pity spared.

OF AFFECTION AND ATTACHMENT.

Some animals, on the contrary, have a kind or affectionate disposition, and also an attachment to others. That "honest creature, (for so we call him,) the dog, who never bites the hand that feeds him," manifests his joy at the approach of his master by antic gambols, and his affection and attachment by leaping up to him and licking his hands. The dog will also resolutely fight for his master, and those individuals who possess great hardihood and determination, will die in his defence. We are fond of dogs, and attach-

ed to them, because they are so to us. Whoever attends to the affections of the mind, will readily perceive that there is nothing more infectious than feelings ; if, therefore, we wish to receive kindness from others, we can only obtain it by showing kindness to them. In the fox, one of the dog tribe, we have an instance of an animal with no other ties than those of nature, living a life of wedlock, unchangeably attached to a single female, to his home, and to his family. Gall and Spurzheim say, that man participates with animals in having, in different degrees, instinctive propensities to kindness and attachment, and also the corresponding organization by which they suppose such instincts to be produced.

OF THE PROPENSITY TO CONCEAL.

That some animals secrete themselves, and dissemble, or are crafty in order to obtain their prey, or secure themselves from injury, is well known ; and Gall and Spurzheim assert, that man has the same propensity, in different degrees, which they call secretiveness. It is certain that many persons are naturally reserved and uncommunicative, and thereby apt to conceal what it is useful that others should be informed of; whilst, on the contrary, there are those who seem to tell all they know or think, even in opposition to the dictates of common prudence, and thus become, not only babblers, but mischief-makers. The propensity to secresy induces us not simply to conceal our opinions, but also to pretend to others, in order to prevent the real ones from being discovered ; and this is generally called cunning.

OF THE PROPENSITY TO HOARD.

Some animals have a propensity to hoard and lay by things; they bury superfluous food, and take it again when they want it; but some hide things which can be of no use to them, and to which they do not return. Gall and Spurzheim assert that man has the same propensity, which, in moderation, induces laudable frugality, but in excess, covetousness and theft.

OF CAUTIOUSNESS.

That some animals, and some individuals of the human race, are cautious and timid, whilst others are precipitate and fearless, is apparent to common observation. The cautious disposition in man, produces a continual appeal to his reason; and, therefore, it is, that we are in the habit of using the terms *circumspect* and *considerate*, as indicative of this feeling.

OF DETERMINATION.

That some animals and men are particularly self-willed, or head-strong, (as the phrase is,) cannot be doubted, which quality is not connected with any particular character, for those of mild tempers often possess it in a high degree. Gall and Spurzheim call this quality determination, and represent it merely as giving force to volition, whatever its object may be. This propensity is the chief cause of refractory conduct in children; and it is natural that they should wish to do what they please, for they have not the motives for restraining their actions which reason and experience suggest. The command of parents should, therefore, stand as the law of reason to the child, which should

be taught the necessity, and acquire the habit, of ready obedience to its decrees. It is also important that the commands of parents should be just, and not unnecessarily and too frequently issued ; lest reason in the former instance, and the dislike of control in the latter, should induce children to rebel against them.

There are some who seem to wish it should be believed, that the instincts of animals, and the curious arts and expedients which they employ to obtain food, and avoid injury, are the effects of reason ; but they cannot maintain this opinion, except by granting to the lowest kinds of animals a greater share of intelligence than they themselves possess, or can have any idea of. We may take some spider's eggs, and when hatched, select a young one who never has had any communication with his species ; and we shall find, that in due season, without a plan or preparatory attempts, it will construct as curious a web as any of his ancestry ; then secrete himself till an unwary fly becomes entangled, which he will suddenly seize and destroy. Gall and Spurzheim, however, represent these animal propensities as operating without reason, when excited by external circumstances. We have an opportunity of witnessing the truth of this representation of the subject where wild beasts are kept. Even the most ferocious and precipitate animals of the cat species do not seem to be insensible of kindness, or devoid of affection and attachment to those that feed them. We see the tygers pleased, and purring and rubbing their heads and sides against the cautiously-outstretched hand of their keeper, but if food be presented to them, the scene is changed in an instant ; we then see the symbol of fury, with outstretched claws, glar-

ing eyes, growling with open mouth, ready to destroy that which it wishes to devour. We see them tear any thing presented to them, nay, even champing their food with a kind of rage, as if they were more gratified by its destruction, than by the satiation of hunger. Had they reason, they would be aware that this fury is both unnecessary and useless. We see a great variety of animal character, we see the same in man; and that these animal propensities operate in him independently of reason, and often in opposition to its dictates, is well known, and so urgent also. are their impulses that some have believed them to be uncontrollable, and founded upon this belief the pernicious doctrine of necessity.

Secondly. I admire the very explicit manner in which Gall and Spurzheim have shown, that, though man resembles animals, in possessing, in various degrees, the foregoing propensities, and even most of the inferior intellectual faculties, he yet differs from them in possessing others, and also superior rational faculties and sentiments, which dignify his nature, and exalt it above his present station. Gall and Spurzheim think that animals possess inferior intellectual faculties, which modify the information received by means of the senses, so as to produce particular kinds of knowledge and talents. Of these inferior intellectual faculties, there are two which seem exclusively to belong to man, those of calculation and language. There are some persons who have a power and facility of calculation, which others, of equal or perhaps superior intellectual ability, cannot by any effort acquire. Languages are learned by the ear, but it is not the acuteness of this organ which qualifies us to learn them; this ability is, according

to Gall and Spurzheim, the result of a separate and appropriate organization. We do not learn to speak, as to write and draw, by willing the several motions necessary to the accomplishment of our designs; for, in general, we know not the motions necessary for the enunciation of words. There is, therefore, a natural consentaneousness between the will and the powers which effect its purposes.*

By the tongue we reveal our knowledge, thoughts, and sentiments, and thus, in some degree, fix and multiply them. By the hand we render valuable information permanent, and raise a common capital of knowledge, from which all may draw an equal share of interest. There are some who represent the intellectual faculties of man to be little superior to those of brutes, and maintain that they become so chiefly in consequence of his possessing organs of speech, and that surprising instrument the hand. They, however, exhibit a very different view of human nature from that on which I am now commenting, which shows, on the contrary, that these organs are but the means by which the superior intellectual powers and sentiments belonging to our nature accomplish their designs.

Gall and Spurzheim assert that some persons have both the disposition and talent of accurately noting and remembering the particulars of each object, event, or proposition, and are thus qualified to become, in an eminent degree, matter of fact men. We see, even in childhood, that some observe almost every thing, but with versatile and insuffi-

*This ready obedience of complicated structures to the mandates of the will, transmitted by actions through the nervous fibres, together with the sympathetic affections of remote parts, excited by similar actions, must, I think, on consideration, appear to every one a subject of great interest and curiosity.

cient attention; whilst others, though less general, are more accurate in their remarks. Now, whether a ready and exact observation be a separate talent or not, it ought to be cultivated with the greatest assiduity, since by it alone do we acquire all the materials of our knowledge; and we cannot reason with propriety upon ill-defined premises. Numerous and unclassed facts are, however, like a great collection of numbers, which it would be scarcely possible to remember without some mnemonic aid. They must be subdivided, and associated with one another, or with something else in order to be remembered. Say that we even decimate a large collection of numbers, we can then get them by heart, as the phrase is, each ten in successive association with one another, and in numeral sequence with the rest, and thus are able to remember the whole collection. We find it often eligible to alter the arrangement of the facts from that in which they have come before us, and arbitrarily or rationally to connect them with other circumstances, in order to render their remembrance easy and permanent.

I see no objection to the classification of the superior intellectual faculties which Gall and Spurzheim have made, into comparison, analysis or causation, and combination; because this arrangement refers to all the elementary powers cognizable in the actions of the human mind: powers which seem exclusively to belong to man. I am even pleased with the station which the organs supposed to be productive of these powers are said to occupy, for we find them arranged in a regular phalanx on a part of the head peculiar to man, the summit of the lofty forehead. As I have said in the lectures addressed to this College, if we find the head more produced in parts peculiar to man,

it is reasonable to suppose that he will possess more of the intellectual character; and if in those parts common also to brutes, that he will possess more of those propensities in which he participates with the brute creation. We are all naturally physiognomists; and almost every observant person has remarked the amplitude of this part of the head to be indicative of intellectual power. Shakespeare denotes the eye as the herald of the mind, which so quickly proclaims its mandates that he compares it to the winged Mercury, new-lighted on a fair and ample hill, so lofty, that, Olympus like, it seemed to touch the heavens.

Though it is very difficult to define the rational processes, yet it is evident that we compare, assort, arrange, separate, and combine facts for the convenience of memory, or for some supposed rational purpose. It is also apparent that they become associated in the adopted order, and further connected with thoughts and feelings; so that the whole chain appears in succession whenever we observe a single link. It is likewise well known, that it is difficult to break faulty associations which may have occurred or been formed through accident or design. In collecting facts, we observe a kind of gradation in them, which often suggests a plan of arrangement. Yet, in accumulating facts, we cannot avoid the exertion of a power of mind peculiar to man, and which is generally termed the power of drawing inferences from facts or propositions. It is by the exercise of this power that we form opinions of the causes, reasons, nature, and effects of what we observe. But having already spoken at large in the lectures addressed to this College, on the caution requisite in forming opinions, and on their importance, and influence on our conduct, I believe that I need not say more on this subject.

A kind and affectionate disposition belongs to animals, and the same feeling, blended with considerations peculiar to man, constitutes benevolence, which is the chief excellence and ornament of his nature. In the language of Shakespeare, it may be said to be "twice blest, for it blesseth him that gives, and him that takes." It produces the same sentiment in others, and thus becomes the bond of society; a source and spring of virtuous actions, and an obstacle to those of a contrary nature. No sentiment can produce more delight than the consideration of our having done good unto others; none is equally permanent; and the constant feeling of good will to all, "sheds a perpetual sunshine o'er the mind." Benevolence must be considered as a sentiment of the mind, as something intimately belonging to it, and operating without the excitement of external causes. Sterne, who has displayed great knowledge of the effects of feelings upon human conduct, shews this, as well as the gratification which results from the operation of benevolence, by saying: "I declare. was I in a desart, I would find out wherewith in it to call forth my affections: if I could not do better, I would fasten them upon some sweet myrtle, or seek some melancholy cypress to connect myself to; I would court their shade, and greet them kindly for their protection; I would cut my name upon them, and swear they were the loveliest trees throughout the forest; if their leaves withered, I would teach myself to mourn; and when they rejoiced, I would rejoice with them."

That persons possess this sentiment in various degrees is manifest, even from childhood. Its excess renders us morbidly sensitive to the distresses of others, and its deficiency so indifferent that we seem to think only of our-

selves. There are some who, possessing this sentiment, do not act in conformity to its dictates: they give pity, but no succour. The exhibition of their natural feelings, like the common courtesies of the world, thus deceive those who confide in them. Surely it must be the consideration of this circumstance, joined with a detestation of deceit, and the consciousness that it is but a duty to do unto others as we would they should do unto us, which produces an anomaly of character both common and well known. Many persons of great benevolence and perfect candour, often suppress all exhibition of good feelings, and treat with harshness those whom they nevertheless effectually relieve and support. By these means putting a mask over the face of virtue, and making it appear disgustful.

Gall and Spurzheim think that there is an organization which occasions its possessor to feel and perform what is just and honourable to be done amongst mankind; and they call the sentiment conscientiousness. This commands us to do what is just, and to perform what we have promised; and of the imperative and controlling influence of this sentiment over human actions, when supported by adequate determination, we have abundant and glorious instances. Brutus condemning his son, and Regulus returning to Carthage, are convincing and sufficient examples.

Some, indeed, might question whether pride had not a great influence in producing such noble conduct. They knew that the eyes of the world were fixed upon them, and that it would be shameful to deviate from what justice and honour cammanded. But we may observe, even in the dawn of life, and within the circle of a single family, that

there are some little children upon whose promises we can depend, and who would not tell a falsehood to screen themselves from shame or punishment. That persons possess this sentiment in very unequal degrees, must, I fear, be admitted; but that none are destitute of it, may, I think, be inferred from all representing their own conduct, however culpable, both to others and to themselves, as conformable, in some respects at least, to the laws of moral rectitude.

Gall and Spurzheim believe that on the outside of the head they can discern the throne of pride and district of vanity. These sentiments are of a similar nature, and can, I think, belong only to rational creatures, for they involve rational considerations. They consist in an exaltation of ourselves in our own opinion, above others, on account of some real or supposed superiority in mind, body, or estate. Pride is a sentiment of a more fixed and independent nature than vanity. The proud man seems indifferent about the good opinion of others, and satisfied with his own. But vanity seems to languish without the food of flattery; and the vain man often appears humble in order to obtain applause. These sentiments, in a limited degree, may be useful, as they prevent us from doing what might lower us in our own esteem or in that of others, and induce conduct which has a contrary tendency. I need not endeavour to shew the absolute absurdity of these sentiments, for on reflection it must be evident to every one; I will merely add, that no faulty sentiments or propensities can render their possessor, in general, more offensive and ridiculous. The want of these sentiments, with due consideration of the rights and claims of others,

according to Gall's and Spurzheim's views of these subjects, constitutes humility, than which no quality can render an individual more amiable and useful. The excitement which pride and vanity may produce to laudable actions is temporary and trivial in comparison with that caused by humility. The former is satisfied and apt to cease when a seeming triumph over others is achieved; whilst the latter induces us constantly to contend with the subjects on which we are occupied, and with ourselves. The proud and vain believe their achievements to result from appropriate talents; but the humble-minded are convinced of the limited nature of their own powers, and that all their attainments have been made by successive portions of labour and meditation. They also perceive how little are their possessions in comparison with their wants, and are thus continually excited to persevere in industry. Humility also is the source of gratitude. Justice may require us to pay the debt of gratitude, but it is spontaneously and redundantly discharged by humility. In proportion as we are humble, so are we thankful for assistance afforded, information communicated, or good opinion manifested.

On the very summit of the head, above other sentiments, instincts, and faculties, Gall and Spurzheim have pointed out a protuberance, greater or less in different individuals, which they believe to be the result of an organization exciting in us respect to distinguished and intellectual characters, even of our own kind, and reverence to the Supreme Intelligent Cause that has ordained and maintains the order of nature, and they have called the sentiment veneration. If this organization be excessive when combined with fear and credulity, they think that it produces absurd superstition; when with pride and unbenevolence,

that it may render its possessors strict and devout in performing the ceremonial duties of religion, though they live in violation of its most essential mandates, without either being humble or charitable; and when combined with arrogance and cruelty, that it may qualify a man to be a judge or executioner in the chambers and dungeons of the inquisition. That people possess this last-mentioned sentiment in very various degrees, cannot, I think, on consideration, be denied.

Adjoining to the organ of veneration, Gall and Spurzheim think that they have discovered organs of faith and hope, both of which they consider to proceed from the same sentiment. It is impossible to hope for what we do not believe can happen; and if we believe expected good may take place, we cannot but hope that it will do so. That some persons have a greater confidence than others in events which they cannot actually predict or influence, may be inferred from the conduct of mankind in general.

There are some persons who have a particular susceptibility of mind, which causes them to perceive so acutely and forcibly, that it leads to exaggeration. They cannot speak of circumstances like men of sober sense, but always express themselves in hyperbole. The strong perception of what is great, good, and beautiful, makes them strive to excel, but it often is an ideal excellence which they aim at, and not such as is attainable by ordinary means or powers. This state of mind Gall and Spurzheim consider as essential to poetic talent, and they call it ideality. Yet this state of mind does not make the poet; for he must have knowledge, or materials, as well as imagination and

abilities to design and construct those compounds of fancy and knowledge which equally delight and inform us. This sensibility of mind operates upon all our faculties and sentiments, and heightens their effect; so that it is productive of good or evil, according to the character and abilities of the party to whom it may belong.

The foregoing representation of human nature, when viewed in its proper light, and with due attention, must, I think, please every one; for it is not like others heretofore presented to us, which appear in comparison but as mere diagrams, the result of study and imagination; whilst this seems like a portrait from life by masterly hands. It is not, indeed, exactly like any individual, but capable, by alterations, of being made to resemble every one; so that by the help of a few touches we are able readily to shew "Virtue her own image, Vice her own deformity," in all their diversities.

I had great gratification in being intimate with Dr. Spurzheim whilst he remained in London, and in a kind of badinage I proposed to him questions which he answered with facility, and in a manner that shewed a very perfect knowledge of human nature. For instance, I enquired whether he had discovered any organ of common sense? and he replied in the negative. I then demanded in what that quality consisted? and he answered, in the balance of power between other organs. This answer shews why a quality so peculiarly useful is common to all, and rare in any: for there are but few who have not prejudices or par-

tialities, hopes or fears, or predominant feelings, which prevent them from pursuing that middle and equal course of thought and conduct, which unbiassed consideration, or common sense, indicates and directs. I enquired of Dr. Spurzheim if there was any organ of self-control, or if not, whence that power originated? He said, "It is the result of a predominating motive: thus, justice may control avarice, and avarice sensuality." In short, I readily acknowledge my inability to offer any rational objection to Gall's and Spurzheim's system of phrenology, as affording a satisfactory explanation of the motives of human actions.

Their representation simplifies our notions of such motives, by lessening the number of reputed agents; thus, the want of benevolence and virtuous dispositions, with excitement to anger, produces malevolence, and this, conjoined with concealment, malice. I need not recite a variety of instances, since they are sufficiently apparent. We perceive that mankind may be naturally benevolent, conscientious, and humble-minded, or the reverse; just as they are naturally timid or fearless, resolute or fickle, candid or reserved; we perceive that they may have natural talents, qualifying them to excel as mathematicians, calculators, linguists, draughtsmen or musicians; and also that they may possess various degrees and kinds of intellectual power. Yet, whatever may be the natural character or abilities of the man, he neither deserves praise nor censure, for he is but what nature made him. We further perceive that real virtue consists in the efforts which we make to cultivate our talents, rational powers, and moral sentiments, and to educate and control the inferior propensities of our nature, so as to allow to each only its proper sphere and mode of action, thereby rendering our conduct conforma-

ble to the acknowledged laws of moral rectitude and religious obligation. And, if we were to examine our own conduct and that of others by this test, we should probably discover but little in the former, which we are warranted warmly to approve, or in the latter strongly to condemn. Nature has not only given to man good and honourable sentiments, but also made it his highest gratification to employ and indulge them; so that we rarely deny ourselves this supreme pleasure, except when prevented by selfish considerations.

Now, Gall and Spurzheim have represented the office of the superior intellectual faculties and sentiments as affording motives and possessing powers that can, and ought, to control and educate the inferior propensities. But there have been, and are some who seem to wish it believed that human actions are under the control of these inferior propensities; allowing, indeed, that the fear of great personal evil may deter us from compliance with their urgent solicitations. They also represent the absence of guilt but as the result of the want of temptation. Yet, if we inquire why such degrading and disgusting views of human nature are presented to us? Why opinions are inculcated which tend to weaken virtuous efforts by declaring their inefficacy? We find that the authors of them, from a review of their own conduct, and that of the baser part of mankind, are convinced that there is no virtue in them, and therefore infer that others must equally want it. Thus do they presumptuously "call virtue, hypocrite," and malevolently "pluck away the rose from the fair bosom of innocence to place a blister there."

But, though the possession of original dispositions, faculties and sentiments, may create a tendency to certain ac-

tions, yet Gall and Spurzheim admit that it is education which produces knowledge and character: it is the disposition and ability to do what has been repeatedly done, and with progressive improvement, that gives us talents and habits of thinking, feeling, and acting, in a particular manner. It is repetition, or education, by which also motives are rendered so predominant that we feel the indispensable necessity of implicit and energetic obedience to their commands, which is called enthusiasm, and which has given rise to glorious deeds, dignifying and exalting human nature far above animal existence. Religious sentiment, conscientious justice, patriotism, and even personal honour, have induced mankind to bear the greatest evils, without betraying any of the unworthy propensities of our nature.

Thus may even the inferior propensities acquire ascendancy and sway: thus may avarice induce a man to starve in the midst of plenty, in order to increase his useless store; and caution to abstain from gratification, from ideal danger; as though a person would not drink from the cup from which others quaffed with pleasure and with benefit, lest something noxious to himself alone might be infused in the liquor. Some would meet death to gratify malevolence, ambition, or sensuality; but is not this the result of repetition, and the education of bad propensities? Surely we must admit that *Nemo repente fuit turpissimus.*

Even facts and opinions may by repetition acquire a preponderance and value that did not originally belong to them. Questionable assertions may by degrees obtain the authority and power of established facts; and opinions, which at first were doubtful, may in like manner acquire a delusive influence over the mind. In insanity, a man may believe

a part of his body to be wasted; nor is the evidence of his sight and touch, which we cannot suppose to be defective, sufficient to convince him of his error.

On the other hand, we may suppress and bring into disuse, propensities and sentiments which may have been naturally strong, till they become naturally inert or inoperative: no better proof of this can be required, or need be adduced, than the complete change of character and conduct which is caused by the intimation of others, and by habits acquired from those with whom we associate; a change so generally known and recognized, that its effects have become proverbial. "Don't tell me," says Sancho Panca, "by whom you were bred, but with whom you are fed."

Yet that there are natural differences in the character and talents of persons is evident: in infancy, we may observe that some are delighted with receiving and bestowing kindness; whilst others accept and return caresses with apathy. At a very early period we perceive a child to be resolute, or undecided, fearful or incautious; candid, or reserved; liberal, or selfish. We also discern various kinds of talents and intellectual powers before it can be supposed that they have been produced by education. These natural differences of character and talent also manifest themselves under the most inauspicious circumstances: a man may be educated as a robber, and pursue his profession with so much zeal and energy that he may acquire its highest honours; he may be the captain of banditti: yet, if nature has given him just and honourable feelings, he will sometimes violate the regulations of the gang, and commit acts of clemency and propriety which many of his comrades

may censure, and call pusillanimous, yet none can wholly disapprove. Do we not also know that great talents have induced self-education, and that plough-boys have become eminent as philosophers and poets?

The representation which Gall and Spurzheim have given, places the sentiments and dispositions in their real situation, in the head; yet, as the brain affects the heart and other parts of the body, mankind have been induced in all ages to believe them situated in the more evidently affected organs; still, I could not but feel surprize that so late and so eminent an anatomist and physiologist as Bichat should represent the heart to be the seat of feeling, and the head of thought. Anger and fright may greatly augment or diminish the actions of the heart; yet the intelligence producing either of these emotions was conveyed by the eye or ear to the brain; first affecting the mind, and secondarily the heart. Good sentiments and dispositions, with serenity of mind, seem to make "the bosom's lord sit lightly on its throne," and produce sensations which may be said "*circa precordia ludere*." Whilst, on the other hand, "some sorrow rooted in the memory, some irrasibly written troubles of the brain," make us feel "as if the full bosom wanted to be cleansed of that perilous stuff that weighs upon the heart." But it is surely as simple, and more correct to express ourselves as Gall and Spurzheim would have us, by saying that a person has benevolent or just sentiments, as that he has a good or an upright heart.

I have contended, in the lectures on physiology delivered before this College, that there are but two opinions which can possibly be entertained concerning the cause of the vital phænomena. We must either believe that they are

the result of properties belonging to the atoms of matter of which living bodies are composed, or of some subtile, invisible, and highly mobile substance or substances, inhering in, and connected with the evident materials of living beings. The latter opinion seems to me the most probable, and is, I believe, that which Mr. Hunter entertained respecting this subject. I have further contended, that though such vital principle or principles may reasonably be considered adequate to produce the phænomena of life in general,* viz. the prevention of putrefaction, the regulation of temperature, the formation of new chemical combinations, and various kinds of vital actions in the substances in which such principle or principles may inhere; thus, in the nervous system, transmitting actions to and from the brain, exciting sensation and communicating volition, and also actions productive of sympathy between remote parts of the body; yet no such principle can be supposed to produce sensation, for it is impossible to suppose that sensation can result from any motion or arrangement of insensible atoms.

I cannot understand what present physiologists mean, when they speak of circumstances in the animal economy of man being the result of his possessing larger organs for the developement of nervous energy. Do they mean to insinuate that the nervous energy is different from vital energy in general? Or, that the organization of the brain and nerves is necessary for the preparation of vital energy? Both propositions are unreasonable, and the latter contradicted by our knowing that the lower kinds of living beings,

* Vide first two Introductory Lectures; and first Lecture of the year 1817.

which have neither brain nor nerves, possess vitality in the most energetic and permanent degree. Neither do I understand what they mean by attributing sensation to those parts where it is supposed to take place.

Do they really put faith in this delusion? The senses of sight, hearing, and smelling, have been termed, both by physiologists and phrenologists, internal senses, because we do not attribute the sensation to the organs which are supposed to perceive; but surely we do not attribute it to any thing internal. If I am in the country, I see the distant hills, the nearer meadows and the contiguous trees. I may hear the tolling of a remote parish-bell, the lowing of the herds in the adjacent fields, and the warbling of the bird perched on the spray above my head. I may smell the sweet odour of the new mown hay in the adjoining fields, and the fragrance of the rose which I hold in my hand. Yet, in every instance, I attribute the sensation to the object which produces it, whether remote or near. So likewise in touch and taste, I believe the body exciting these sensations, to be where it really is; yet it must be admitted that perception is in every instance in the brain alone.*

The researches of science seem to have confirmed the conjectures of Hartley relative to the functions of the nervous system, and shewn that there is a subtile substance, which he called æther, occasioning vibrations in the nervous fibrils, and thus exciting sensation, and communicating volition. These vibrations may recur as miniature vibrations in the brain, and reproduce sensations, and also imagination and thought. They may recur in the same

* See Introductory Lectures.

order in which they have formerly taken place, or promiscuously, so as to produce perceptions which could never have been excited by objects in nature. If a person who has been "long in populous cities pent," goes a day's journey in the country, when he closes his eyes at night, he is pleased with the fanciful views of rural scenery which present themselves before him. Or when the nervous system is disordered, we may be annoyed or appalled by the appearance of loathsome and hideous phantoms. In the common state of sleep, it is manifest that the actions of life in the nerves, as well as in the muscles, generally are in a state of repose; so that they must be cerebral actions only which then create appearances, revive remembrances, and excite the mind to proceed with its own imaginations, and to feel and think as in matters of fact: thus producing the incidents, and the whole drama of a dream. Nay, even while we are awake, actions of nerves unexcited by external causes may take place, and produce the appearance of persons and things, "in form as palpable" as realities.*

However, I readily concur in the proposition, that the brain of animals ought to be regarded as the organization by which their percipient principle becomes variously affected. First, because in the senses of sight, hearing and smelling, I see distinct organs for the production of each sensation. Secondly, because the brain is larger and more complicated in proportion as the variety of affections of the percipient principle is increased. Thirdly, because diseases and injuries disturb or annul particular faculties and affections, without influencing others; and,

* Ferriar on Apparitions.

Fourthly, because it seems to me more reasonably to suppose that whatever is perceptive may be variously affected by means of vital actions transmitted through a diversity of organization, than to suppose that such variety depends upon original differences in the nature of the percipient principle.

If, from considering the variety of our senses, and their total want of correspondence to the causes which must undoubtedly produce them, I mean the impulses of masses or atoms of surrounding substances exciting actions in our nervous fibrils, and also, from the consciousness we possess of the unity of that which perceives, attends, reasons, decides, and wills, I am compelled to admit, as I have formerly argued in the lectures given in this College, that all variety of sensation results from the nature and attributes of something most wonderfully and inexplicably perceptive. How much more strongly am I compelled to believe that all those curious propensities, faculties, and sentiments, of which I have this day spoken, are attributes of the same substance. Indeed, to me it seems impossible that any rational being should suppose reason and the nobler sentiments of our nature to arise from organization, or mere vital actions.

Whilst, then, I most readily concede to what is demanded in this system of organology, that the variety of effects produced may be the result of modifications of vital actions transmitted through diversities of structure, I most strongly protest against the opinion, that the organs themselves are perceptive; or, indeed, against any opinion which impugns the belief of the unity of that which is perceptive, rational, and intelligent. Many of our actions are the re-

sult of complicated thoughts and feelings, each seeming to have yielded a portion of its peculiar interests, so as to produce a modified result. But how, may I ask, has this compromise been made? A gentleman once humourously answered this question by saying, that it was done by committees of the several organs, and a board of control. But if an intelligent, discretionary, and controlling power be granted, I feel no disposition to demand any more.

The perceptive and intellectual phænomena cannot be rationally accounted for upon the supposition that the brain is an assemblage of organs, each possessing its own perceptiveness, inteligence, and will. There must be a common centre, as I may express it, to which all the vital actions tend, and from which all attention, ratiocination, decision, and volition proceed. Our attention may be so inactive or absent, so occupied by our own imaginations and thoughts, or abstracted, that we are scarcely conscious there is any thing surrounding us. Though we possess extensive perception by means of vital actions, yet we attend to but one subject at a time. We can direct our attention to any of our various sensations and feelings, to the operation of any of our faculties and sentiments; and, therefore, if Gall's and Spurzheim's opinions of the structure of the brain be true, that which is attentive must have communication with all parts of this organ. Nor can we do less than admit that what is attentive to all our sensations and faculties must of itself be perceptive and intelligent. Reason and thought are inferences from information obtained by means of the vital actions, and cannot therefore be considered as the immediate effect of such actions. If, then, we remember our own thoughts, it must be in consequence of their recurrence to that which thinks, It is difficult to remem-

ber them unless we connect them with objects of sense, with something renewable by the recurrence of vital actions. Brilliant imaginations, judicious inferences, new and seemingly correct views of subjects, may be conceived in thought, and yet lost from not thus registering and fixing them. Now, as we reason and think on all the subjects of our knowledge, it is evident that whatever performs these acts must have communication with all parts of the brain.

The eye cannot judge of sensations produced by the ear, nor the ear of those of smell, taste, and touch, yet we decide on all our sensations, faculties, and sentiments; consequently, whatever exercises this power must be acted upon by all parts of the brain.

The vital actions in the brain recur spontaneously, and promiscuously in sleep, as has been said, so as to create images, and excite imaginations, feelings, and thoughts. They can also be renewed by volition. We may endeavour to retrace the objects we have seen, till their spectre arise to our view; or meditate on music we have heard, till the sounds seem to vibrate on the ear. When we see only indistinct forms and shades, we can convert them into finished pictures. Thus do we seem to recognise the features of our approaching friends, when their distance renders it impossible that we should distinguish them; and to form as exact a resemblance of objects in the fire and clouds, as could be depicted by great labour and talent. Thus can we review all the subjects of our knowledge. We can arbitrarily call to mind the transactions of a journey undertaken many years ago, or con over the arguments of a discourse which we may have lately heard. It must,

therefore, be admitted, that the will operates upon all parts of the brain.

By repeatedly calling up these vital actions we render them prompt and habitual, and thus keep alive in our memories whatever we may deem worthy of remembrance. Yet, when we cannot recall them, we are, nevertheless, confident that we have possessed the knowledge which we seek. We try to discover it by some circumstance with which it was connected, and if we find but the associating link, we are instantly assured of our perfect memory of a long chain of incidents. In what, may I ask, exists this assurance of forgotten events, or of perfect memory, when we discover but a single link in a long chain of circumstances? Surely we must answer, in that which has perceived and thought.

Of the unity of that which perceives, attends, thinks, decides, and wills, nature has given us a consciousness which no argument can annul, and which enquiry only strengthens. I wish to avoid metaphysical discussions in this place, but it seemed necessary to shew that the consideration of the phænomena of mind, as well as that of the phænomena of life, equally enforces the opinion of their distinct and independent nature; thus confirming the notions that it is natural man should entertain relative to his own being, and which are necessary to his proper conduct in life. Uneducated reason, and the utmost scientific research, equally induce us to believe, that they are composed of an assemblage of organs formed of common inert matter, such as may be seen after death; a principle of life and action; and a sentient and rational faculty; all intimately connected, yet each distinct from the other.

The impossibility of our conceiving how any thing intelligent can exist, and become connected with, so as to affect or be affected by the organization of living beings, has led to unanswerable enquiries; which, however, cannot reasonably be made, except in consequence of supposing that what is perceptive resembles the subjects of its perception, of which alone we can form any ideas. But it is not irrational to conclude, that things totally different in properties may be equally different in nature, and thus has it been inferred, that the mind does not resemble the subjects of its perceptions, but is, in its nature, neither mutable nor liable to decay, like the common forms of matter by which we are surrounded, and of which our bodies are composed.

No one seems better to have understood the faculties and sentiments of the human mind, or to have exerted them to better effect, than Socrates. As he was a sculptor in the early part of his life, he was in the habit of saying, "How strange is it that we should take so much pains to fashion an insensible stone into the likeness of ourselves; and so little to prevent ourselves from resembling an insensible stone?" He was constantly exhorting others to try to improve their talents and moral character, as he himself had done with so much advantage and comfort to his own mind. But what was the cause of this continual effort in behalf of others? or whence arose that elevation of sentiment and perfect self-command which this philosopher possessed? Surely from the belief that his present state of existence was but preparatory to one exalted and eternal. After he had drank the poison, one of his friends, anxious about his funeral, enquired of him what were his wishes respecting a subject, which, to any real philosopher, must appear altogether unimportant. "Bury me," said Socrates, "where

you please, provided you can catch me ; for it seems that I, Socrates, who now reason with you, cannot convince you that when I quit this lifeless body, I shall be no longer present."

PHYSIOLOGICAL LECTURES.

ADDRESSED TO

THE COLLEGE OF SURGEONS.

BY

JOHN ABERNETHY, F.R.S.

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SURGEON TO ST. BARTHOLOMEW'S AND CHRIST'S HOSPITALS.

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AN

ENQUIRY

INTO THE

PROBABILITY AND RATIONALITY

OF

MR. HUNTER'S

THEORY OF LIFE;

BEING THE SUBJECT OF

THE FIRST TWO ANATOMICAL LECTURES

DELIVERED BEFORE THE ROYAL COLLEGE OF SURGEONS OF LONDON, IN THE YEAR 1814.

TO THE

TRUSTEES

OF THE

HUNTERIAN COLLECTION,

THESE

INTRODUCTORY LECTURES

EXHIBITING

AN IMPERFECT SKETCH OF THE CHARACTER

AND SOME OF THE OPINIONS OF

MR. JOHN HUNTER,

ARE RESPECTFULLY INSCRIBED

BY THEIR OBEDIENT SERVANT,

THE AUTHOR.

INTRODUCTORY LECTURES

IN THE YEAR 1814.

LECTURE I.

IN succeeding Sir William Blizard in the honourable office of Professor of Anatomy and Surgery, I think it right to inform my audience that he was my earliest instructor in these sciences; and that I am greatly indebted to him for much, and most valuable information respecting them. My warmest thanks are also due to him for the interest he excited in my mind towards these studies, and for the excellent advice he gave me, in common with other students, to direct me in the attainment of knowledge.

"Let your search after truth," he would say, "be eager and constant. Be wary in admitting propositions to be facts before you have submitted them to the strictest examination. If, after this, you believe them to be true, never disregard or forget any one of them, however unimportant it may at the time appear. Should you perceive truths to be important, make them motives of action; let them serve as springs to your conduct."

"Many persons," he remarked, "acknowledge truth with apathy; they assent to it, but it produces no further effect on their minds. Truths, however, are of importance, in proportion as they admit of inferences which ought to have an influence on our conduct; and if we neglect to draw those inferences, or to act in conformity to them, we fail in essential duties."

Our preceptor further contrived by various means to excite a degree of enthusiasm in the minds of his pupils. He dis-

played to us the *beau ideal* of the medical character :—I cannot readily tell you how splendid and brilliant he made it appear ;—and then, he cautioned us never to tarnish its lustre by any disingenuous conduct, by any thing that wore even the semblance of dishonour. He caused the sentiment of the philanthropic Chremes, in the Heautontimorumenos of Terence, to be inscribed on the walls of the hospital-surgery, that students should have constantly before them an admonition to humanity, drawn from a reflection on their own wants : Homo sum ; humani nihil a me alienum puto.

I could with pleasure enlarge on this theme, but I check myself, because I am aware that what I am now saying may rather annoy than gratify the feelings of my preceptor. What I have stated, however, is a tribute due from me to him ; and I pay it on the present occasion, in hopes that the same precepts and motives may have the same effect on the minds of the junior part of my audience, as they were accustomed in general to have upon the pupils of Sir William Blizard.

That which most dignifies man, is the cultivation of those intellectual faculties which distinguish him from the brute creation. We should indeed seek truth ; feel its importance ; and act as the dictates of reason direct. By exercising the powers of our minds in the attainment of medical knowledge, we learn and may improve a science of the greatest public utility. We have need of enthusiasm, or of some strong incentive, to induce us to spend our nights in study, and our days in the disgusting and health-destroying avocations of the dissecting-room ; or in that careful and distressing observation of human diseases and infirmities, which alone can enable us to understand, alleviate, or remove them : for upon no other terms can we be considered as real students of our profession. We have need of some powerful inducement, exclusively of the expectation of fame or emolument : for unfortunately a man may attain a considerable share of public reputation and practice without undertaking the labours I have mentioned, without being a real student of his profession. I place before you the most animating incentive I know of to labour truly to acquire professional knowledge. You will by such conduct possess yourselves of the enviable power of being extensively useful to your fellow-creatures, in a way the most necessary to their wants, and most interesting to their feelings. You will be enabled to confer that which sick kings would fondly

purchase with their diadems; that which wealth cannot command, nor state nor rank bestow. You will be able to alleviate or remove disease, the most insupportable of human afflictions, and thereby give health, the most invaluable of human blessings.

I shall not, however, gentlemen, waste your time in expatiating on this topic, because you will feel much more than I can utter, and because all that can be said or thought of it, seems concentrated in one brief but enthusiastic sentence of Cicero, which therefore I quote. In nulla re, propius ad deos homines accedunt, quam salutem hominibus dando.

In occupying the situation of the last gentlemen who taught in this place, Sir Everard Home, who has pursued the path of science which Mr. Hunter pointed out, with a considerable talent for observation, and with a degree of zeal and industry, scarcely to be expected from one whose time and attention have been otherwise so much engaged; I also, equally with him, feel interested in impressing on the minds of my audience, the advantages we have derived from the labours of Mr. Hunter, and from pursuing that mode of study and enquiry which he adopted, and inculcated: and I am desirous on the present occasion, to engage your attention in the consideration of the probability and rationality of his theory of life.

The term theory, in philosophical language, like hypothesis, denotes the most plausible and rational mode of accounting for certain phænomena, the causes of which have not been fully developed. In applying these terms to medical and physiological subjects, I may be allowed to define what I think they designate, and what I intend to convey by them. By the word theory I mean a rational explanation of the cause or connexion of an apparently full or sufficient series of facts: by hypothesis, a rational conjecture concerning subjects in which the series of facts is obviously incomplete.

The formation of an hypothesis excites us to enquiries, which may either confirm or confute our conjectures; and which may, by enabling us to discover the deficient facts, convert our hypothesis into a theory. Believing the facts collected by the ingenuity and industry of Mr. Hunter, to be

sufficient to establish his opinions respecting life, I have therefore called them a theory.

There was a time when medical men entertained so determined a dislike to the word theory, that they could scarcely tolerate the term. If any such remain, I would beg them to reflect that hypothesis and theory are the natural and inevitable result of thinking; so that if they refuse to allow of any theory, they must prohibit all thought.

The antipathy which some have entertained to the term theory has arisen from its misapplication. For opinions drawn from very partial views of subjects, sometimes having no foundation on facts; opinions formed by processes of mind, similar to those which occur in dreaming, when lawless imagination produces combinations and associations without any reference to realities; opinions, as unlike what I should understand by theory as darkness is to light, have nevertheless been often proposed as theories and so denominated. That such foolish speculations, such waking dreams, will mislead and deceive us, cannot be doubted; and hence has arisen the prejudice which some have entertained against the term.

The greatest philosophers were, through the whole course of their enquiries and demonstrations, theorists. Theorizing, according to my conception of the word, means nothing more than thinking correctly, in a concatenated manner, and in conformity to rules which I shall presently have occasion to notice. It is scarcely necessary for me to assert that this kind of thinking is useful, and promotive of Science. For was it not thinking in this manner on the cause of an apple falling from a tree, that led Sir Isaac Newton to ascertain the laws of attraction? Was it not thinking thus which led him to perceive that the operation of the same causes might perpetuate the regular motions of the planetary system? Why do we note facts with accuracy, or collect them with diligence? why do we interrogate nature by experiment? Is it not because we wish to prove some of our own opinions to be true, or the opposing opinions of others to be false? or, because we wish to enlarge the boundaries of science in a direction in which we think they admit of extension? What induces one person to prohibit another from theorizing? Is it not because he has himself attempted it in vain, and therfore deems the attempt unavailing?

Feelings and opinions are the chief sources of all our intel-

lectual conduct: we ought therefore to cultivate good and honourable feelings, and to scrutinize opinions, with a view to entertain none but those that appear correct; and such an examination, to which I now invite you, must be allowed to be a proper exercise of intellect.

Since thinking is inevitable, our chief enquiry should be how we ought to think or theorize; and on this point Newton himself has condescended to instruct us. Our theories, hypotheses, or opinions, for to me all these words seem to refer to one and the same act of the mind—should be verifiable or probable, and should rationally account for all the known phænomena of the subject they pretend to explain; under which circumstances it is allowable to maintain them as good, until others more satisfactory be discovered. No man who thus theorizes need feel shame in this employment of his intellectual powers; no man can feel arrogance, for it is acknowledged that his theory is but a probable and rational conjecture. Besides, we never can be sure that the series of facts belonging to any subject is full or complete; new ones may be discovered, that would overturn our best established theories.

Upon the foregoing terms alone do I wish to uphold Mr. Hunter's theory of life; and I do so on the present occasion, because it seems highly probable, it was his thinking in the manner he was known to do, that caused him to survey all the facts connected with the subject of life in general with so much accuracy, as well as to note its disordered states and sympathies in a manner which has so greatly contributed to increase our practical knowledge. It is highly probable that it was his hypothesis respecting life which incited him to enquiries by which he has been able to supply the deficient facts, so as to establish his conjectures, or convert his hypothesis into a theory.

Mr. Hunter seems to have put us into a right path, and every step we take our prospects become more enlarged and distinct, and we evidently approximate to the ultimate object which we have in view.

Whoever duly reflects on the extent of human knowledge and power, cannot but feel an interest in anatomical enquiries: since he must perceive that it is by means of the organ-

ization of the body, the mind acquires all its information, and executes all its purposes. When, however, we engage in anatomical enquiries, we find so great a diversity of structure in the different parts of the body; so great a variety of expedients for affecting certain purposes, all so simple in their nature, yet so adequate to their intended design, that anatomy becomes highly interesting from the curiosity it excites, the knowledge it imparts, and the food for meditation it affords.

When also in the prosecution of our anatomical enquiries, we as it were analyze the body, or reduce it to its elementary parts: when we find that every organ, and every portion of it is composed of a few and simple vessels, a few and simple fibres; that by these it is originally formed, kept in constant repair, endowed with animation, sensation, and motion; we become lost in astonishment that such important ends can be effected by apparently such simple means.

On reflecting how I might best accomplish the duty which devolves to me, of giving anatomical lectures in a place by no means suited to anatomical demonstrations, I thought I could not do better than speak of the structure and functions of these elementary component parts of the body; since by this method I should be led to describe their natural and healthy structure and functions, which would be a proper introduction to the subsequent discussions I have to engage in, relative to the nature and treatment of disorder and disease. As it does not seem material which subject I consider first, I shall begin with the fibres, the only visible means by which motion and sensation are produced; for this will lead directly to the consideration of Mr. Hunter's Theory of Life.

In surveying the great chain of living beings, we find life connected with a vast variety of organization, yet exercising the same functions in each; a circumstance from which we may I think naturally conclude, that life does not depend on organization. Mr. Hunter, who so patiently and accurately examined the different links of this great chain, which seems to connect even man with the common matter of the universe, was of this opinion. In speaking of the properties of life, he says "it is something that prevents the chemical decomposition, to which dead animal and vegetable matter is so prone; that regulates the temperature of the bodies it

inhabits, and is the cause of the actions we observe in them." All these circumstances, though deduced from an extensive contemplation of the subject, may, however, be legitimately drawn from observations made on the egg. A living egg does not putrify under circumstances that would rapidly cause that change in a dead one. The former resists a degree of cold that would freeze the latter. And when subjected to the genial warmth of incubation, the matter of it begins to move or to be moved so as to build up the curious structure of the young animal.

The formation of the embryon in gallinaceous ova was particularly attended to by Mr. Hunter; and he was of opinion, that motions began in various places in the cicatricula so as simultaneously to form parts of the embryon and its appendages.

The opinions of Mr. Hunter deserve at least to be respectfully and attentively considered. That he was a man of genius, according to the beautiful definition of that quality given by Dr. Johnson; that he possessed the power of mind that collects, combines, amplifies, and animates the energy without which judgment is cold, and knowledge is inert; cannot I think be doubted by any one who has carefully considered his writings. That he was a man of uncommon industry, by which he collected abundance of facts, will be admitted by every one who has even beheld his museum. That he was a man of constant and deep reflection, is to me equally apparent.

Many persons have genius without industry; others industry without genius; and many who possess both are still deficient in judgment.

I here beg permission to explain the notions I entertain of that act of the mind by which we form our inferences, opinions, or judgments. I shall by this means at once unfold what it is that, in my estimation, gives currency and value to the opinions of any individual, and entitles them to the attention of others. The human mind has the power of holding as it were in review, a series of facts or propositions, and steadily contemplating them so as to arrange, assort, or compare them till we form some deduction respecting them. This power seems to belong exclusively to man, and is the basis of his reasoning faculty. That mind is the strongest which can contemplate the greatest number of facts or propositions with accuracy; and his judgments are generally the most correct.

who omits to review none of the facts belonging to the subject under his consideration. It was this power of mind that so eminently distinguished Newton from other men. It was this power that enabled him to arrange the whole of a treatise in his thoughts, before he committed a single idea to paper. In the exercise of this power, he was known occasionally to have passed a night or day entirely inattentive to surrounding objects.

That Mr. Hunter was also a man of constant and deep reflection, that he possessed this enviable power of mind, so essential to the perfection of the intellectual character, is to me sufficiently apparent; for I know of no opinion of his that was lightly or loosely formed, or that was not logically and cautiously deduced from the facts before him; and though from the subsequent increase of knowledge, the validity of some of his opinions may now be doubted, yet most of them have from the same cause become more firmly established. With all his genius, knowledge, and reflection, Mr. Hunter was not, however, a brilliant character amongst us. He had not the happy talent of displaying the stores of his mind, nor of communicating to others the same perception of the importance of his facts and opinions as he himself entertained. Perhaps it may have arisen from my attending more to his facts and opinions than to his mode of explaining them, that I have been led to form so high an estimate of his intellectual powers. I can draw no other inferences from the facts than those which he has drawn, and therefore am I a convert to his opinions.

I proceed now to consider the structure and functions of those fibres which constitute the muscles, in order to introduce the discussion of the probability and rationality of Mr. Hunter's Theory as a cause of irritability. Muscular fibres are soft and readily lacerable in the dead body, and even during life, when they are in a state of inaction. They are composed of that insoluble substance which we meet with in the blood, and which, from its disposition to concrete in a fibrous form, is called the fibrous part of that fluid. The threads and flakes of common cellular substance, which connect the muscular fibres, and every where pervade the structure of a muscle, may be removed by boiling, and then the muscular fibres may be separated, till they become too minute to admit of further separation, and almost elude our unassisted sight. Yet there are some who assert, that by

the aid of powerful lenses, each fibre, though slender as the threads of flimsy gossamer, appears but as a muscle in miniature, being composed of a number of smaller fibres. There are others who maintain the contrary, and affirm that they can see the ultimate muscular fibres. It would seem to me a waste of time to detail to you the reports of various microscopical observers, respecting the ultimate fibres of muscles, since there is so little concurrence or certainty in their descriptions. The opinion which such contradictory statements have impressed on my mind, is, that perhaps the ultimate arrangement of matter, like its ultimate particles, may form a subject too subtile for human perception. Our information in these respects must be limited, as our powers of perception have their bounds. The imperfection of the human senses, does not, however, seem a subject of regret; because it induces a greater necessity for the exertions of intellect; and many subjects appear far more demonstrable to reason than to sense.

Fontano, it must be granted, possessed considerable talent in microscopical observations; for he says, that he could readily distinguish the nature of any animal substance, which might be placed on the field of his microscope, by regarding its ultimate fibres, and according to him the muscular fibres are much smaller than those of the nerves. Proscasca and others assert, that the ultimate muscular fibres are continued throughout the whole length of a muscle. How marvellous, (could we but see it,) would such a slender thread appear, continued throughout the whole length of the human sartorius. Haller, however, affirms that the fibres are not continued, but that one set terminating another begins. Suspecting that Haller employed the solar microscope on this occasion, as he says he had done on others, I examined muscular fibres with this instrument. Now, though I place no confidence in my own observation, and think the subject unimportant as to any conclusion that may be deduced from it, yet I will tell you how a portion of a muscle appeared to me when magnified about 500 times. The fibres were slightly undulating, and one set terminating, another began: neither were the sets of fibres of considerable length. The muscular fibres were connected by cross threads of common cellular substance.

Mr. Carlisle, in whose talents and accuracy we are all disposed to place confidence, in the Croonian Lecture,

printed in the Philosophical Transactions for 1805, says, that he can distinctly see an ultimate muscular fibre, which he describes "as a solid cylinder, the covering of which is reticular membrane, and the contained part a pulpy substance irregularly granulated." He has also described the termination of nerves in muscles.

Muscles are liberally supplied both with blood vessels and nerves, but nothing peculiar is perceived in their distribution. We make them very red by injecting them, and we see numerous nerves entering their substance at various places. Yet the vessels of some muscles are too minute to receive red blood on our coloured injections, so that redness though a common is not an essential character of muscle.

I here willingly relinquish the enquiry into the structure of those organs in which the irritable property chiefly resides, in order, in the next place, to speak of the principal phænomena of irritability.

Muscles have the power of contracting with surprising celerity and force. It seems indeed wonderful that the biceps muscle of the arm, which in the dead state would be torn by the weight of a few ounces appended to it, shall in the living state be capable of lifting and sustaining more than 100 lbs. The matter in the muscle seems neither to be increased nor diminished during its contraction, what is lost in length being gained in bulk. The voluntary contraction of muscles cannot be long continued; they become weary and painful, the contraction remits and recurs, causing a tremulous motion. Yet this phænomenon does not seem to be the effect of absolute inability, in the irritable property, to continue in action, for some muscles continue to act without experiencing fatigue. For instance, those of the jaws and back; for whenever they relax the jaw drops, and the head and body fall forwards, as we see in persons who are going to sleep in a sitting posture. Certain sphincter muscles likewise remain in action without experiencing fatigue. Some sphincters also, I may add, are disposed to yield considerably without impatience; so that their irritability resembles that of those muscles which Bichat has considered as a distinct class, and subservient alone to what he calls the organic life. The contractile power of muscles is also capable of remaining in vehement action for a great length of time, as we see in some cases of cramps, and still more in some cases of tonic tetanus.

Yet though the irritable power is not incapable of contin-

ued exertion, it seems evidently to be in general susceptible of fatigue, and inclines to be at rest. If we stimulate the muscles of a limb of a frog severed from the body, by voltaic electricity, the muscular actions are at first vivid and forcible, but they grow fainter and feebler on repeated excitement. Yet if we wait a little till they seem to regain their power, they become vivid and forcible as at first from the same degree of excitement. Such actions may be excited at intervals for twenty-four hours, though with a gradual diminution in their power, after which, in general, they can be no longer excited, and then the muscles become permanently and rigidly contracted. The foregoing facts appear to me to show the impropriety of the phrase, exhausted irritability, which is in common use to express our inability by the effort of our will to continue the actions of our voluntary muscles: it seems manifest that the irritability is not exhausted but fatigued.

The rigid contraction of the muscles after death, is the effect of irritability: it is its last act. A considerable force is required to overcome this contraction, or to bend the rigid limbs of the dead body, when it has recently taken place. The force required to effect this, gradually diminishes till the muscles become quite pliant; and then, and not till then, does putrefaction ensue.

Mr. Hunter has known this last vital contraction to occur in parts severed from the body sixty hours after their separation, upon the removal of causes which had impeded the contraction before that period; a proof that life in a certain degree was still resident in the part. He observed that death produced by lightning, or large charges of electricity, or by certain kinds of injuries and diseases, prevented this contraction, and even the coagulation of the blood; and that putrefaction would in such cases very rapidly take place. From facts of this kind, as well as from many others, he drew an inference, which has not I believe been disputed, and therefore I need not enter into the discussion of it at length, that the principle of life may in some instances be suddenly removed, or have its power abolished, whilst in general it is lost by degrees.

The contraction of irritability takes place in some animals in a very slow and gradual manner, and their muscles in general are incapable of sudden contraction. Yet though the action of their muscles is very slow, it is very powerful and

very permanent. The American sloth supports its weight for a very long time in one attitude, by fixing its claws into the branches of trees; an act which would speedily weary muscles of an ordinary character. The muscles of the legs of birds that roost, seem to have a similar power of permanent contraction.

Mr. Carlisle has lately demonstrated a peculiar distribution of the arteries in the limbs of these tardigrade animals, as they are called, and Doctor Macartney has shown that a similar arrangement of vessels exists in the legs of fowls. Such a distribution of the arteries may be subservient without being essential to these modes of action.

In the human body we see instances of irritability exerting itself after the manner it does in general in tardigrade animals. If the iris had possessed the ordinary powers of muscles, and none else, it could not have remained, as it is known to do, permanently contracted in a strong light, and permanently dilated in a weak one. Indeed, an anatomist who is fond of tracing structure as connected with function, might readily persuade himself, that there is in the iris a distribution of arteries, similar to that which Mr. Carlisle has demonstrated in the limbs of sloths. We find, however, that sphincter muscles in general have the power of continuing their contraction, though no peculiar distribution of vessels is discoverable in them. In the gall bladder, the function of which requires this slow but permanently acting irritability, in order to express its contents in small and equal quantites into the bowels, as the digested aliment passes into them, we discover no peculiar arrangement of arteries.—Though we cannot excite any sudden contraction of that bag, yet we know that it can gradually reduce itself into a very small compass. The skin has every where this slow but permanently acting, and gradually relaxing irritability, the effects of which are most evident in lax and pendulous portions of it. Accordingly we sometimes observe the scrotum and prepuce condensed into a surprizingly small and very compact mass.

Thus have we even in the human body evidences of irritability acting in various modes, whilst we can equally perceive that in tardigrade animals some of their muscles act with celerity. In the lori, of whose habits Vosmaer has given so interesting an account, and which manifested no signs of alacrity save in eating the food that it liked, no stimulation nor injury could induce it to mend its pace, but it shows

ed its resentment of the attempt to make it perform impossibilities, by suddenly snapping at the stick or instrument with which it was goaded; and thus again demonstrated that the muscles of its jaw were endowed with an irritability of the more common character.

Having thus briefly described the principal phænomena of muscular action, for I forbear to notice others of less importance, I proceed to review the conjectures that have been formed as to the cause of these curious, sudden, and powerful contractions. Not to speak of exploded hypotheses, I trouble you only with those which are modern.

First, then, the contraction has been supposed to be the effect of some chemical change occurring in the part. This opinion is I think invalidated by the reiterated contractions which may be produced in the limbs of some animals when removed from the body, even during twenty-four hours, if excited by voltaic electricity, and consequently when no supply of materials can be supposed to exist within the limb, to produce such reiterated chemical changes. The opinion is still further refuted by observing, that these vivacious contractions will equally take place, upon the same excitement, in the exhausted receiver of an air-pump and in the open air. They may also be excited under water, under oil, in a great variety of gases; in short, under circumstances which exclude the presence of any chemical agent from without, to which such changes could reasonably be imputed.

Secondly, the contraction of irritability has been supposed to be a property of the muscular fibres. Properties are generally considered as permanent qualities. Thus, the property of gravitation is continually operating, equally when bodies remain at rest and when it produces motion in them, equally whilst I support this book in my hand, and when I suffer it to fall on the table. If, however, so curious an occasional property could belong to matter, we should naturally expect that it would belong to some peculiar quality, or arrangement of matter. But irritability is connected with matter of different qualities and arrangements. The flesh of animals and that of fish are different in quality; the pulpy medusæ which float in the sea differ from vegetables; yet all are irritable, or possess this power of occasional contraction. Though in general we find irritability connected with a fibrous structure, yet, if we may trust our senses, it is not so in every instance. In the hydatid, where no such structure is appa-

rent even with the aid of lenses, we still have evidence of the irritability of life. If also, as I strongly suspect, the muscular fibres be not continued from one end of the muscle to the other, irritability could not in that case be considered as a property belonging to them, since any breach of continuity would completely frustrate the contraction of the whole muscle.

Thirdly, I proceed to enquire into Mr. Hunter's opinion, that irritability is the effect of some subtile, mobile, invisible substance, superadded to the evident structure of muscles, or other forms of vegetable and animal matter, as magnetism is to iron, and as electricity is to various substances with which it may be connected. Mr. Hunter doubtless thought, and I believe most persons do think, that in magnetic and electric motions, a subtile invisible substance, of a very quickly and powerfully mobile nature, puts in motion other bodies which are evident to the senses, and are of a nature more gross and inert. To be as convinced as I am of the probability of Mr. Hunter's Theory as a cause of irritability, it is, I am aware, necessary to be as convinced as I am that electricity is what I have now supposed it to be, and that it pervades all nature. To obtain this conviction it is necessary that the facts connected with this subject should be attentively considered; but for such an examination I have no time; neither would it be considered as suitable to the general design of these lectures.

Whatever notions philosophers may be pleased to form respecting matter in general, it does not appear to me that our physiological opinions can be effected by their decisions. Of the matter which for the most part presents itself to our notice, and is cognizable by the eye and touch, we know that it has a property called by Sir Isaac Newton *vis inertiæ*, an indisposition to move unless impelled to motion, and a disposition to continue in motion unless retarded.

There are some philosophers who think, that properties similar to those of the aggregate mass, likewise belong to every atom of which it is composed; whilst others, on the contrary, think, that the atoms have very different qualities, and that the *vis inertiæ* is the property only of the aggregate mass. The matter of animals and vegetables is, however, an aggregate mass; it is as we express it, common matter, it is inert; so that the necessity of supposing the superaddition of some subtile and mobile substance is apparent.

Taking it for granted that the opinions generally entertained concerning the cause of electrical motions are true, analogy would induce us to suppose, that similar motions might be produced, by similar causes, in matter organized as it is found to be in the vegetable and animal systems.

The phænomena of electricity and of life correspond. Electricity may be attached to, or inhere, in a wire; it may be suddenly dissipated, or have its powers annulled, or it may be removed by degrees or in portions, and the wire may remain less and less strongly electrified, in proportion as it is abstracted. So life inheres in vegetables and animals; it may sometimes be suddenly dissipated, or have its powers abolished, though in general it is lost by degrees, without any apparent change taking place in the structure; and in either case putrefaction begins when life terminates.

The motions of electricity are characterized by their celerity and force; so are the motions of irritability. The motions of electricity are vibratory; so likewise are those of irritability. When by long-continued exertion the power of muscles is fatigued, or when it is feeble, their vibratory or tremulous motions are manifest to common observation, but the same kind of motion may be perceived at all times by attention, as has been shown by Dr. Woolaston in the Croonian Lecture for the year 1810. It is then I think manifest, that Mr. Hunter's conjectures are the most probable of any that have been offered as to the cause of irritability.

My allotted time does not permit me at present to consider the other vital functions; yet I relinquish the subject with reluctance, because I have been speaking only on that point in which it seems most difficult to persuade the incredulous, of the probability and rationality of Mr. Hunter's Theory.

When hereafter I shall have to speak of the other vital functions, I think it will appear that it is impossible to account for the phænomena in any other manner than that which Mr. Hunter has suggested.

In ascending the difficult and lofty ladder of knowledge, men of great talent and industry seem to have affixed to it certain resting places, on which, reposing for a time from their labours, they could tranquilly assemble their followers, and contemplate more extensive views of nature, and of na-

ture's laws, than had before been taken. If after having stood by the side of the great teacher Newton, and learned from him the properties of common and inanimate matter, we afterwards attend to Mr. Hunter, our great instructor in the functions of living beings, he points out to us how matter, starting from the general mass, springs up into life in vegetation. We see vegetables as it were self-formed and producing their own species. We observe them also exerting most of the powers which animals possess. That they have irritability is evident from the current of their sap and their secretions; nay, in some we observe those vivacious motions which seem chiefly to belong to animal life, as is evident in the Mimosæ, the Dionæa Muscipula, and Heydysarum gyrans. We see them like animals having alternate seasons of action and repose; and though in general vegetables like animals are in action during the day and rest in the night, yet also some vegetables like some animals rest in the day and are in action during the common season of repose.

We see animals scarcely differing from vegetables in their functions, like them doomed to a stationary existence, with even less appearance of organization than we usually discover in vegetables, and of a structure so simple as to admit of propagation like vegetables by cuttings. Yet in all the diversity of living beings we recognize certain processes peculiar and essential to life; as the power of converting other kinds of matter into that appropriate to the individual it is to form and support; the power of distributing the nutriment, thus converted, to every part for its formation and supply; the ventilation, as I may call it, of the nutritive fluids; the power of preparing various dissimilar substances from the nutritive fluids; and the propagation of the species. As what is deemed the complexity of animal life increases, we find distinct organs allotted for each of these functions; thus we have organs of digestion, circulation, respiration, secretion, and generation, which are various in their structure in the different tribes of animals.

In vegetables, and in some of the lower kinds of animals, no traces of nerves are discoverable. The nervous system begins in a simple form, and seems to increase in complexity up to man. But this will make the subject of the next lecture. Mr. Hunter also shows us that there are animals, as for instance the torpedo and gymnotus, which have organs liberally supplied with nerves, forming an electric battery

which they can charge at will. Such facts show to what a degree electricity exists in these animals, and how greatly it is under the influence or control of the nervous system; and they could not fail to make a strong impression on the contemplative and deeply meditating mind of Mr. Hunter.

What, then, may I ask, is the natural inference to be drawn from the examination of this great chain of being, which seems to connect even man with the common matter of the universe? What but that which Mr. Hunter drew, that life must be something independent of organization, since it is able to execute the same functions with such diversified structure, and even in some instances with scarcely any appearance of organization at all?

The experiments of Sir Humphrey Davy seem to me to form an important link in the connexion of our knowledge of dead and living matter. He has solved the great and long-hidden mystery of chemical attraction, by showing that it depends upon the electric properties which the atoms of different species of matter possess. Nay, by giving to an alkali electric properties which did not originally belong to it, he has been able to control the ordinary operations of nature, and to make potash pass through a strong acid, without any combination taking place. That electricity is something, I could never doubt; and, therefore, it follows as a consequence, in my opinion, that it must be every where connected with those atoms of matter, which form the masses that are cognizable to our senses; and that it enters into the composition of every thing inanimate or animate. If then it be electricity that produces all the chemical changes, we so constantly observe, in surrounding inanimate objects, analogy induces us to believe that it is electricity which also performs all the chemical operations in living bodies; that the universal chemist resides in them, and exercises in some degree peculiar powers because it possesses a peculiar apparatus.

Sir Humphrey Davy's experiments also lead us to believe, that it is electricity, extricated and accumulated in ways not clearly understood, which causes those sudden and powerful motions in masses of inert matter, which we occasionally witness with wonder and dismay; that it is electricity which causes the whirlwind, and the water-spout, and which "with its sharp and sulphurous bolts splits the unwedgeable and gnarled oak," and destroys our most stabile edifices; that it is electricity which, by its consequences, makes the firm earth tremble, and throws up subterraneous matter from volcanoes.

When therefore we perceive in the universe at large, a cause of rapid and powerful motions of masses of inert matter, may we not naturally conclude that the inert molecules of vegetable and animal matter, may be made to move in a similar manner, by a similar cause?

It is not meant to be affirmed that electricity is life. There are strong analogies between electricity and magnetism, and yet I do not know that any one has been hardy enough to assert their absolute identity. I only mean to prove, that Mr. Hunter's Theory is verifiable, by showing that a subtile substance of a quickly and powerfully mobile nature, seems to pervade every thing, and appears to be the life of the world; and therefore it is probable that a similar substance pervades organized bodies, and produces similar effects in them.

The experiments of Sir H. Davy seem to realize the speculations of philosophers, and to verify the deductions of reason, by demonstrating the existence of a subtile, active, vital principle, pervading all nature as has heretofore been surmised, and denominated the Anima Mundi. The opinions which in former times were a justifiable hypothesis, seem to me now to be converted into a rational theory.

It is then, I think, manifest, that Mr. Hunter's Theory of Life, presents us with the most probable solution of the phænomena of irritability, of any that has hitherto been proposed.

The human mind has been the same at all periods of the world; in all ages there have been men of a sceptical disposition, disinclined to believe any thing that was not directly an object of their senses. At all periods there have been other men of a contemplative, and perhaps more credulous character, who have been disposed to believe that there were invisible causes, operating to produce the alterations which are vissible, and who from much less numerous facts have drawn the same inferences that I have done. And many of these, from Pythagoras downwards, have expressed their sentiments, though with some variety, yet pretty much to the same effect. The Greek philosophers recognized in man, the Σομα, Ψυχη, and Νȣς, the body, vital principle, and mind, whilst some used words significant of intellect, to express the energizing principle in nature, without apparently having any clear ideas of intelligence.

What was called the Anima Mundi, was, however, by

many considered as a distinct and active principle, and was not confounded with intelligence of any kind. I know not how I can better exhibit to my audience the subject I am alluding to, or better acquaint them with the general tenour and tendencies of these opinions, than by quoting that portion of these philosophical notions, which Virgil is said to have put into the mouth of Anchises:

> Spiritus intus alit, totamque infusa per artus
> Mens agitat molem, et magno se corpore miscet.

And please to observe, gentlemen, it is Virgil says, it is Anchises speaks, that which I also this day have been saying;—

> Inde hominum pecudumque genus, vitæque volantum
> Et quæ marmoreo fert monstra sub æquore pontus.

LECTURE II.

I PROCEED to speak of the structure and functions of the nervous fibres.

The nerves which we observe pervading the body, appear to be packets of very minute threads, seemingly distinct from each other. The nerves divide and subdivide, and in so doing a certain number of threads separate from the original packet, and appear as a distinct nerve. It is, therefore, possible to trace a minute nerve, up to its origin, from the toe or finger, by splitting it off from the various packets with which it has been conjoined. So far does anatomical fact concur with the physiological opinion, that every nervous filament communicates distinctly with the brain or some process of that organ.

This apparent continuity is, however, lost, whenever we find those intumescences on nerves which are called ganglia. for in these there seems to be a mixture or consolidation of the nervous matter. It is also lost wherever various nerves unite together, and form a plexus; in which case the nervous fibrils either coalesce, or become inextricably interwoven with one another.

The nerve from which the thoracic and abdominal viscera are chiefly supplied, is beset with numerous ganglia and plex-

uses; and as we cannot by our will influence the actions of those viscera, and as the iris, the motions of which are also involuntary, is supplied with nerves from a ganglion, it has been thought that ganglia, by intercepting the direct communications between the brain and the extreme branches of nerves, might render parts thus supplied less amenable to the will, and less under the influence of the general affections of the nervous system. It is also thought that ganglia might serve the office of subsidiary brains, each affording a separate source of nervous energy.

On the other hand, it ought to be observed, that all the vertebral nerves, supplying parts over which the will exerts the most perfect control, have ganglia at their commencement; and that the nerves of the leg and arm form a plexus near their origin. The actions of the cremaster muscle are involuntary; yet I believe it is supplied by the same nerves, which supply muscles that are subject to voluntary actions; therefore this opinion does not appear to me to be such as we should receive with entire confidence. Again, it is further apparent, that the functions of the abdominal and other viscera are greatly affected by disorders of the brain, and that the brain is greatly affected by disorders of these viscera.

The ingenious and industrious French anatomist, Bichat, has classed the living functions into the organic and animal: the distinction seems a natural and useful one, and throws light on the physiology of the visceral nerve. In vegetables, and in some of the lower kinds of animals, no traces of a nervous system are discoverable. In others of the lower order of animals, that have organs for the preparation and distribution of nutriment, they are supplied by a visceral nerve, which it is probable maintains amongst those organs a concurrence of impressions and actions. In the ascending complexity of the nervous system, we find a nervous chord more or less beset with ganglia, which supplies other parts of the body besides the viscera, and which probably serves to maintain amongst them likewise a concurrence of impressions and actions. We next find at one end of this chord a kind of ganglion, or brain, which gradually becomes larger and more complex as we trace the series of links upwards to man, in whom it bears a much larger proportion to the nervous system in general than in any other animal. The visceral nerve, in the ascending series of animals, appears connected with the animal nerves; and so numerous are these connections,

that this nerve has in the human subject obtained the title of the great sympathetic nerve.

The vital organs are required to carry on their functions with a degree of regularity and order, under the varying circumstances of life; and the possession of a distinct nerve may enable them to continue their functions without so materially participating in the disturbances of the animal system, as they must otherwise have done: yet the numerous connections of the visceral with the animal nerves must render both participators in each other's disorders.

The nerves, then, may be said to proceed from the brain, medulla spinalis, and visceral nerve, to all parts of the body for their supply. In thus expressing a fact, however, we should guard against an idea which the analogous distribution of arteries is apt to engender. Arteries become minute in proportion as they send off branches, whilst, on the contrary, the branches of nerves are often larger than the trunk from which they proceeded. It is no unfrequent occurrence for mal-formed children to be born without a brain, yet with a perfect nervous system. The most rational idea, therefore, we can entertain on the present subject, is, that the nerves are formed in the parts where we find them, and that they are connected to those parts of the organs from which we are accustomed to say they proceed. Nerves are vascular, and we can inject them with subtile injections.

The nerves, then, proceeding from, or being connected with the brain, medulla spinalis, and visceral nerve, may be traced, ramifying throughout the body in the manner already mentioned, till they arrive at the part for the supply of which they are designed. They then split into numerous branches which communicate with each other, and again subdivide and rejoin, their communications appearing to multiply as they become more minute; so that every part of the body has a kind of net-work of nerves, in proportion to the susceptibility and sensibility it possesses.

This general and imperfect sketch of the anatomy of the nervous system, relates only to what may be discovered by our unassisted sight. If by means of the microscope we endeavour to observe the ultimate nervous fibres, persons in general are as much at a loss as when by the same means they attempt to trace the ultimate muscular fibres.

Those fibres which we can split off from a nervous packet, in the manner before mentioned, though too minute to admit

of further subdivision, appear by the microscope to be themselves packets of smaller threads. It is generally asserted by microscopical observers, that the nerves and medullary matter of the brain and spinal marrow are the same, and are composed of very minute fibres. Fontano speaks confidently on this point; and he further says, that he has seen these nervous fibres regenerated in the medium which has been formed to unite a divided nerve. He describes the nervous fibres in every part of the nervous system as cylindrical, pursuing a slightly undulating course, and being in a considerable degree transparent. He states also that they are larger than the ultimate fibres of muscles.

Microscopical observers also tell us, that though the nervous fibrils in each packet appear distinct, and may be separated from each other in the manner already described, yet they have nevertheless transverse communications with each other. Each nervous fibre has been supposed to be covered by investing membranes similar to those of the brain; but this opinion is founded on an analogy with what is observed in the optic nerve, rather than on actual observation with respect to others. That they have investing membranes is clear, and we are told that we may dissolve the medullary or nervous matter by an alkali, and leave these investing membranes; or on the other hand, that we may dissolve the investing membranes by nitric acid, and leave the medullary fibres.

Having thus spoken of the chief circumstances relating to the anatomy of the nervous system, I shall not dwell on this part of the subject, but hasten to the principal object of the lecture, to consider its physiology, in order to examine how far Mr. Hunter's Theory of Life, seems adequate to explain the phænomena of the nervous functions.

First, then, it is generally believed that all sensation is in the brain, and that all volition proceeds from that organ. This proposition requiring to be impressed so as to produce conviction, for it is the foundation on which all our future reasoning is founded, I shall state the principal causes of this opinion. First, If the coutinuity of a nerve be intercepted at any point between that extremity which receives impressions from the objects of sense, and which therefore may be called the impressible or tangible extremity, and that which communicates with the brain, and is usually called its sensorial extremity, both feeling and volition by means of that nerve are suspended.

2dly. If a certain degree of pressure be made upon the brain, both feeling and voluntary motion cease whilst it continues and return when it is removed.

3dly. As we have evidence that the perceptions and intellect of animals increase in proportion as the brain becomes larger and more complex, so we have reason to conclude that these faculties are connected with that part of the nervous system.

4thly. The conviction which we generally though not constantly experience, that feeling exists in the part which receives impressions, is shown to be deceptive by the following facts. If a nerve be irritated midway between the brain and its extremities, severe pain is supposed to be felt in those extremities; and if it supplies muscles, those muscles become convulsed. Thus when a disease forms about the hip joint, or in the loins, many persons have applied poultices to their knees, from a conviction that the pain was felt in the knee, it was the seat of the disorder. In like manner, persons who have had their limbs amputated, can scarcely believe that they are removed, because of the pain and other sensations they still seem to feel in them. In either of these cases, motions being excited in the middle of nerves, and transmitted to the brain, are attributed to a disordered state of those parts from which such motions have heretofore originated.

If, then, it be admitted that sensation exists in the brain, and that volition proceeds from that organ, it necessarily follows that motions must be transmitted to and fro along the nervous chords, whenever they take place. It was formerly supposed that these chords were passive, and might be made mechanically to vibrate, but their want of elasticity and tension, and their pulpy origins and terminations, are circumstances which render such a supposition inadmissible. Physiologists were therefore led to conjecture that the nervous fibrils were tubular, and that they contained a subtile fluid, by means of which such motions were transmitted.

Of the extensive knowledge and high intellectual powers of Baron Haller, no one can entertain a doubt; and yet, he could devise no other theory to account for the phænomena of the nervous functions. His opinions have always appeared to me very sensible, and they were accordant to the philosophy of his own times. He says, Si vero, cogitata nostra de ipsa natura spirituum proferre juberemur, activum ad motum, a voluntate et a sensu concipiendum, aptissimum, celerrimum, omne sensuum acie subtilius. tamen hactenus igne et

æthere, et electro, et magnetica materie crassius facere elementum, ut et contineri vasis et a vinculis coerceri aptum sit: et denique manifestum ex cibis nasci et reparari queat.

Mr. Hunter's opinion of a subtile and mobile substance, inhering in the nervous chords, is not essentially different from that of Haller. He does not indeed suppose it to be confined in tubes, neither does the philosophy of the present time require such a supposition, for no one at present will doubt that a subtile substance may be attached to or inhere in a chord without mechanical confinement. Will not a wire when electrified continue to be so, if surrounded by non-conductors? Experiments made on the limbs of animals with electricity, produced in the manner first explained by Volta, show that different parts of the body have different conducting powers. Skin and membrane being very bad conductors, and brain, muscle, and blood, being remarkably good ones.

The celerity with which motions are transmitted from the tangible extremities of nerves most distant from the brain, and the celerity with which volition is transmitted to the muscles in consequence of sensations thus induced, are sufficient to convince us that such effects must be produced by the motions of a very mobile substance. It is not necessary to suppose that when such motions are transmitted along the nervous chords, an evident motion of the visible matter of those chords should be induced. Electrical motions take place along a wire without occasioning any visible motion of the metal itself.

Formerly, it was thought that the motions of the nerves that cause sensation, were the effect of an impulse made on their tangible extremities, which was propagated along the chord to the brain. It seems to be an improvement in modern physiology, to attribute sensation to an action begun in the nervous fibrils, in consequence of the stimulation which they suffer from such impulses. This opinion is contended for by Dr. Darwin, in his paper on ocular Spectra, published in the Philosophical Transactions; and Sir Everard Home has further shown, that the living principle of nerves has an irritability belonging to it, resembling that of muscles, and capable of causing a contraction in them when they are divided.*

* Croonian Lecture.

The opinion that sensation is the consequence of an action begun in and transmitted through the nervous fibrils, assists us in understanding how our sensations may be very vivid from the slightest impulses; such, for instance, as take place in the application of odour to the olfactory nerves, for it is not the impulse, but the consequent action, that is transmitted to the sensorium: and why we may have no sensation from the most violent impulses; for such we cannot but suppose to occur, when a man is shot through the body, or has a limb removed by a cannon-ball; occurrences which have, however, happened without any distinct feeling intimating the event.

In supposing a principle of life in nerves, similar to what is conceived to exist in muscles, we might naturally expect to find certain analogies of functions in those organs. The facility, celerity, and accuracy of the nervous actions, seem like those of the muscles to be improved by use; as is exemplified in the quick and correct perceptions of those who are accustomed to exercise their auditory nerves in attending to musical sounds. A train of nervous actions having often taken place, they, like similar actions in muscles, become concatenated, and are liable to occur in succession, when one of them is accidentally induced. Both nerves and muscles require temporary respites from action, and are refreshed by sleep.

The supposition of actions occurring in the nerves, explains many circumstances connected with diseases. Vehement actions may occur in the tangible extremities of nerves, independent of impulses, and occasion severe pain. This seems to happen in the disease called tic douloureux. Ordinarily, actions beginning in the tangible extremities of nerves, are regularly transmitted to the brain; but in cases of nervous pains, actions sometimes seem to begin in the middle of nerves; and it is probable, that actions beginning in the sensorial extremities of nerves may be productive of illusory sensations, and excite fallacious ideas.

If this theory of nervous actions could be proved, the extent of our knowledge would only lead to this conclusion, that motions of a subtile substance, propagated to and fro in the nervous fibrils, take place in consequence of excitement by impulses and volition; but from such motions, it seems impossible to account for sensation or volition. We can conceive no variety in these motions, but what relates to degree,

duration, and succession, and it seems impossible to believe that sensation can be the result of such motions, or that ideas can arise from any succession or train of them. Certain persons will, therefore, I doubt not, continue to think that sensation, remembrance, comparison, judgment, and volition are properties of some distinct substance.

The essences or primitive parts of what we call matter, are too subtile to be perceived by our senses, and seem even to elude our conceptions. Is it not then most philosophical to acknowledge our ignorance on these points, and to speak of what we do know, the properties of the different species of substances in nature. Thus we seem to be acquainted with the properties of the aggregate forms of that substance which is cognizable to the eye and touch, and which we then call matter; we seem to be assured of the existence, and to know something of the properties, of a subtile substance which pervades all nature; and if we are allowed to know any thing, we surely may be admitted to know the properties of our own minds.

How diversified are our perceptions, how admirably are they adapted to our wants and gratifications! for all beauty of prospect, all melody of sound, all variety of odour, must by the eye of reason be perceived to result from the masses or molecules of surrounding matter, being in various states of motion or of rest: of which circumstances we have notice by the actions they induce in our nervous fibrils. Such variety of perceptions I can only consider as the effect of the peculiar properties of that which feels, remembers, reasons, and wills, and which seems connected with the brain alone.

The conclusion to be drawn from this examination of the functions of the nervous system is curious and interesting. We perceive an exact correspondence between those opinions which result from physiological researches, and those which so naturally arise from the suggestions of reason that some have considered them as intuitive. For most reflecting persons in all ages have believed, and indeed it seems natural to believe, what modern physiology also appears to teach, that in the human body there exists an assemblage of organs, formed of common inert matter, such as we see after death, a principle of life and action, and a sentient and rational faculty, all intimately connected, yet each apparently distinct from the other.

So intimate, indeed, is the connection as to impose on us

the opinion of their identity. The body springs and bounds as though its inert fabric were alive; yet have we good reasons for believing that life is distinct from organization. The mind and the actions of life affect each other. Failure or disturbance of the actions of life prevent or disturb our feelings, and enfeeble, perplex, or distract our intellectual operations. The mind equally affects the actions of life, and thus influences the whole body. Terror seems to palsy all its parts, whilst contrary emotions cause the limbs to struggle, and become contracted from energy. Now, though these facts may countenance the idea of the identity of mind and life, yet have we good reasons for believing that they are perfectly distinct. Whilst, therefore, on the one hand, I feel interested in oppugning those physiological opinions which tend to confound life with organization, I would, on the other, equally oppose those which confound perception and intelligence with mere vitality.

In the first lecture I endeavoured to show that Mr. Hunter's Theory of Life was verifiable, and that it afforded the most rational solution of the cause of irritability, which had hitherto been offered to the public. It now appears that it does not essentially differ from that of the best physiologists, with regard to the explanation it affords of the nervous functions. As it is impossible to review all the phænomena of these functions in a lecture, I shall on the present occasion merely direct your attention to the consideration of one other subject, which is, the opinions we may be warranted in forming. respecting the connection of irritability and sensibility.

This subject has been the cause of much controversy. Haller maintained that irritability was a distinct property inherent in muscles; to use his own words, that they had a vis insita, independent of the vis nervea; which opinion has of late received additional corroboration from some experiments of Mr. Brodie. Those who object to this opinion, can, I think, only oppose it on the following grounds. They must contend either that the muscles have a kind of perception of injury which causes them to contract, even though they are unconnected with the brain; or that the nerves are the organs which prepare and supply the muscles with something which is the cause of irritability.

Concerning the first of these suppositions, that muscles may have a perceptibility of injury, distinct from that which we understand to be feeling, I have to observe, that we can

have no idea of sensation but what results from our own experience, which may be defined to be perception attended with consciousness; which kind of sensation is confined to the brain alone. Of any other kind of perception, it is evident we can never form any idea.

If a man's leg be amputated, and by voltaic electricity I excite contraction in its muscles for some hours, how can I know whether they feel or not? We naturally judge of other subjects from ourselves, and knowing that we shrink from whatever pains us, some persons seem to conclude that the muscles contract because they have been hurt. To the patient who has suffered amputation, such a supposition would seem absurd. He may feel pain when no stimulus is applied to the limb, or he may feel ease when it is. Nay, he continues to feel pain, or sensations, in the limb when it is rotten, or no longer in existence; which seems to show the integrity of the sentient principle remaining in the brain

In vegetables, and in some of the lower kinds of animals, no traces of a nervous system are discoverable, yet the irritability of life is manifest in all. In the ascending series of animals in proportion as the brain becomes large and complex, we have evidence of the perceptions and intelligence increasing; a circumstance which would lead us to believe that these faculties were connected with that part of the nervous system. We have also equal reason to believe, that neither such perception nor intelligence is requisite for the mere functions of life, for these appear to be carried on as effectually in animals that have no brains, nay, in those which seem destitute of any nervous system, as in those which possess such organs. Indeed, many of the most vivacious and irritable animals have the least nervous system. The nerves in the lower order of animals, that have no common sensorium, may contribute to produce effects, which, in tracing the ascending series, I have endeavoured to express by the words concurrence of impressions and actions; because intimations of impressions and actions occurring in one part may be communicated to others by these inter-nunciate chords, as Mr. Hunter called them, in cases where we are not warranted in supposing there is any sensation such as I have defined.

Assuredly, motion does not necessarily imply sensation; it takes place where no one ever yet imagined there could be sensation. If I put on the table a bason containing a saturated solution of salt, and throw into it a single crystal; the act

of crystallization would begin from the point touched, and rapidly and regularly pervade the liquor till it assumed a solid form. Yet I know I should incur your ridicule, if I suggested the idea that the stimulus of the salt had primarily excited the action, or that its extension was the effect of continuous sympathy. If also I threw a spark amongst gun-powder, what would you think were I to represent the explosion as a struggle resentful of injury, or the noise as the clamorous expression of pain?

Now though chemists may solve the cause of these phænomena, physiologists have yet to learn, and probably they never may learn, why certain actions succeed to certain causes in living bodies. Causes which induce muscular or nervous actions in one part, do not induce similar actions in another. Both muscles and nerves have peculiar habitudes and modes of action, and require the application of various peculiar excitements. Causes which produce no bad effect upon one person, will have a detrimental influence upon another, and this we say is the result of idiosyncrasy. Thus the odour of a cat, or the effluvia of mutton, the one imperceptible, the other grateful to the generality of persons, has caused individuals to fall on the ground as though bereaved of life, or to have their whole frame agitated by convulsions. Substances which induce disease in one person or animal, do not induce disease in others. That pain is not the cause of action, is I think evident. Nervous motions, induced by the will, cause our muscles to act, but such motions occasion no sensation in the obedient muscles. When, therefore, we employ the terms in common use of a stimulus being applied, and an action or disease excited, we should remember that neither the infliction of pain, nor absolute injury, is essential to the production of such consequences.

With respect to the second proposition, into which I have resolved the objections that may be made to Haller's opinion of irritability being independent on sensibility, I have only to remark, that the effects of pressure made on nerves, as well as other observations, have induced the general belief that some fluid or energy pervades the nerves for the supply of the body. Pressure on a nerve benumbs and paralyzes the parts which it supplies, which regain sensation and motion on the removal of the pressure; yet if irritability exists in vegetables and some animals that have no nervous system, it shews

the possibility of irritability being produced without the intervention of nerves.

It has been my object to show that Mr. Hunter's Theory of Life is a verifiable Theory, and that it affords the most rational explanation of the phænomena of irritability, and of those nervous functions that have been considered. It is, however, impossible in the compass of a lecture, as I have before observed, to review all the phænomena of the nervous functions, which it is necessary to do in order to establish it as a rational Theory. The contemplation of this subject at large, is fitter for meditation in the closet than for discussion in the lecture-room. I shall, therefore, merely mention by way of exciting attention to some of the phænomena alluded to, that it seems impossible to account for those which Mr. Hunter considered as the effect of sympathies between remote organs, or for those consequences of idiosyncrasy which have been mentioned, upon any other supposition than that of a subtile substance, prone to act, or liable to fail in action, pervading the body, the affections of which can with electrical celerity be propagated throughout the system.

I have further to show that Mr. Hunter's Theory of Life is adequate to explain the cause of the prevention of putrefaction, and the regulation of temperature. If the vital principle of Mr. Hunter be not electricity, at least we have reason to believe it is of a similar nature, and has the power of regulating electrical operations. That electricity is the great chemist both in organized and unorganized bodies, will be generally credited; and that the power which combines may also prevent decomposition, is too obvious to need discussion. That electricity is capable of augmenting and diminishing the temperature of unorganized matter is well known. Does not platinum-wire drop like wax infusion when it intervenes between the different ends of the voltaic battery? and do not the spherules of rain fall to the ground at midsummer as firmly frozen as in the depth of winter, when they pass through a stratum of air refrigerated by electrical operations? I believe I need say no more on these subjects.

The varying and the strong retention of life by seeds, and some kinds of vegetables and animals, are facts which seem more satisfactorily solved by Mr. Hunter's Theory of Life than by any other.

Impressed with the difficulties of the task I have undertaken, of giving lectures in the presence of men of superior knowledge and talents, respecting subjects on which every one has formed his own opinions, which of course he thinks correct; though desirous of fulfilling the design of these lectures to the extent of my ability, I feel unable to display the subjects of them in any other way than that to which I have been accustomed. Thinking, as Mr. Hunter taught, with regard to life and its functions, in health and disorder, I must use his language as expressive of the phænomena we observe. That an attention to the sympathies of parts and organs is necessary to our understanding disorder and disease, I shall hereafter endeavour to show. That Mr. Hunter did observe these sympathies in a manner and to an extent that surprized most professional men, is well known to all those who were present at his lectures on this subject. Their surprize was indeed natural, because they were not then fully acquainted with his views and motives.

I mention these things, because I am aware that there are some who say sympathy is a term without any direct meaning, and that all which Mr. Hunter said on the subject of life, explains nothing. What Mr. Hunter meant, I believe I understand; what persons of different sentiments, whom I acknowledge possess great information and ability, mean, when they talk in this manner, I am not so well able to discover. They seem to deny that life can be any thing which may not be seen or felt. They seem to wish us to believe that they have that philosophical turn of mind which exempts them from vulgar prejudices, and that no Theory appears to them satisfactory, neither do they propose any for our adoption.

Thinking being inevitable, we ought, as I said in the beginning, to be solicitous to think correctly. Opinions are equally the natural result of thought, and the cause of conduct. If errors of thought terminated in opinions, they would be of less consequence; but a slight deviation from the line of rectitude in thought, may lead to a most distant and disastrous aberration from that line in action. I own I cannot readily believe any one who tells me, he has formed no opinion on subjects which must have engaged and interested his attention. Persons both of sceptical and credulous characters form opinions, and we have in general some principal opin-

ion, to which we connect the rest, and to which we make them subservient; and this has a greater influence on all our conduct. Doubt and uncertainty are so fatiguing to the human mind, by keeping it in continual action, that it will and must rest somewhere; and if so, our enquiry ought to be where it may rest most securely and comfortably to itself, and with most advantage to others? In the uncertainty of opinions, wisdom would counsel us to adopt those which have a tendency to produce beneficial actions.

If I may be permitted to express myself allegorically, with regard to our intellectual operations, I would say, that the mind chooses for itself some little spot or district where it erects a dwelling which it furnishes and decorates with the various materials it collects. Of many apartments contained in it, there is one to which it is most partial, where it chiefly reposes, and where it sometimes indulges its visionary fancies. At the same time it employs itself in cultivating the surrounding grounds, raising little articles for intellectual traffic with its neighbours, or perhaps some produce worthy to be deposited amongst the general stores of human knowledge.

Thus my mind rests at peace in thinking on the subject of life, as it has been taught by Mr. Hunter; and I am visionary enough to imagine, that if these opinions should become so established as to be generally admitted by philosophers, that if they once saw reason to believe that life was something of an invisible and active nature superadded to organization, they would then see equal reason to believe that mind might be superadded to life, as life is to structure. They would then indeed still farther perceive how mind and matter might reciprocally operate on each other by means of an intervening substance. Thus even would physiological researches enforce the belief which I may say is natural to man; that in addition to his bodily frame, he possesses a sensitive, intelligent and independent mind: an opinion which tends in an eminent degree to produce virtuous, honourable, and useful actions.

PART OF THE

INTRODUCTORY LECTURE

FOR THE YEAR 1815,

EXHIBITING SOME OF

MR. HUNTER'S OPINIONS

RESPECTING DISEASES.

DELIVERED BEFORE THE ROYAL COLLEGE OF SURGEONS, IN LONDON.

BY JOHN ABERNETHY, F.R.S. &c.

PROFESSOR OF ANATOMY AND SURGERY TO THE COLLEGE.

ADVERTISEMENT.

The following Sheets comprise only an Extract from the Introductory Lecture of the present year, which is designed to explain some of Mr. Hunter's opinions respecting Diseases.

The pages are numbered, in continuation with those of the Introductory Lectures of the preceding course, printed last year, in order that the whole may be bound together.

INTRODUCTORY LECTURE.

1815.

LECTURE III.

I PURPOSE on the present occasion, to take a general review of the subjects, which engaged our attention last season; and, to offer some comments upon them.

In the preceding year, I first exhibited the facts I had collected, relative to those general disorders of the system, which are so frequently produced by local disease, injury, or irritation. These Mr. Hunter considered to be the result of universal sympathy, of that sympathy which the whole system seems to have with its several parts. In each of these disorders, indeed, it is evident that the whole system is affected; the nervous functions are impaired or disturbed; as are also those of the digestive organs, and of the sanguiferous and secerning systems. Yet we denominate these general disorders from their most prominent character. Thus, when the sanguiferous and secerning organs are chiefly affected, and the temperature of the body is subject to considerable variations, we call the disorder fever. Of fevers, some are violent or inflammatory, but of short duration; some more languid and continued, becoming, as it were, habitual or hectical; and there are others, in which the actions are vehement, though the powers are feeble; these cannot be long continued, for they are speedily destructive of life: the last also frequently so strikingly resemble Typhus, as not to be distinguishable from that fever when it arises from other causes. I also further shewed that the same local excitements would produce intermittent and rheumatic fevers; and occasion still more diversified and unexpected disorders.

Now, here I would ask, to whom do we owe the first lu-

minous demonstration of this subject: who, first with the eye of a physiologist, surveyed the reciprocal sympathies of the several organs of the body, and shewed how the most complex disorders may and do arise from simple causes? Was it not Mr. Hunter? Allow me, further, to enquire, does no good result from this physiological exhibition of the subject? Its utility might be explained by numerous instances, but I shall restrict myself to one. When we see that a compound fracture, in a susceptible and debilitated patient, may so disorder the nervous functions, that all the organs and parts of the body are affected, as in that complicated malady—a typhus fever; can we longer feel surprised, that disorder of the digestive organs and poisonous miasmata should equally and similarly impair and disturb the energies of the nervous system, and occasion this identical fever? Does not this discernment of the causes and nature of diseases, lead to a just appreciation of various remedies, and to judicious practice?

Whilst considering the constitutional effects resulting from what Mr. Hunter called *universal sympathy*, I further shewed that the nervous disturbance, induced by local irritation of remote parts, might produce effects more or less general upon the nervous and muscular systems, without so materially affecting the other organs of the body as to engage the attention of common medical observers; and here I spoke of pain, sickness, swooning, rigors, convulsions, delirium, and tetanus.

Lastly, in considering the effects resulting from these sympathies, I shewed how the nervous disturbance might affect the feelings and functions of the digestive organs, and how the disorder so induced, might, by a reflected operation, augment the former, and greatly and variously disturb the whole system.

This subject had indeed particularly attracted the attention of Mr. Hunter, who believed that the stomach had a direct sympathy with remote organs and parts of the body; whilst he equally observed, how it might reciprocally affect and be affected by the head. It was on this account, probably, that he was led to call the stomach the centre of sympathies, a term, which such observations, if correct, would render particularly apt and expressive.

The full importance of this subject, could not, I think, have been discovered by the most acute physiological observation. It has been, however, manifested by the results of medical practice, which shew that if the disordered feelings and func-

tions of the digestive organs be removed, the greatest degrees of nervous disorder, will sometimes suddenly cease; at others, will be greatly mitigated, and gradually subside; clearly proving, that in such cases, the one derangement is the cause of the other.

To this subject, I particularly claimed your attention, because, it seems to me perfectly demonstrable, that the continued and aggravating irritation which the brain, and abdominal viscera, when disordered, impart to each other, is productive of a state of constitution, of which, (to express my notions in the briefest way I could.) I said, that it proved the fruitful parent of a numerous and dissimilar progeny of local diseases. On this account, the disorders of the digestive organs should become an especial object of attention, in the treatment of local diseases; for it is in vain to expect that such diseases, which may be considered as effects, should admit of cure, whilst the causes that produced them are left to operate in force sufficient for their maintenance or their production in other parts of the body.

Having thus considered the nature and treatment of constitutional maladies, so far as the subject is applicable to the practice of Surgery; I proceeded, in the next place, to speak of local diseases, and first, of those which often arise spontaneously, though they may sometimes be induced by external injury, and which also may occur in almost every part of the body.

Here too, it may be observed, that the whole of the local affected district is disordered; that the nervous functions and vital energies of the part, are either impaired, excited, or disturbed, and that the functions of the vascular systems of the part are also deranged. Yet here, likewise, we denominate the disorder from its most prominent character; thus, when the sanguiferous system is chiefly affected, we name the disease Inflammation. Of inflammations, as of fevers, it may be observed, that some are violent and of short duration; some languid and continued, or chronic; whilst, in others, the actions are vehement, though the powers are feeble, and the latter cannot be long continued, for if they do not soon subside, they destroy the life of the affected part.

We seem to consider violent or phlegmonous inflammation to be simply the result of an increased action of vessels, though probably this disease has its varieties; in the other species of inflammations, the varieties are evident and nu-

merous. In chronic inflammation, we sometimes see the substance deposited in consequence of the increased action of vessels, such as is usually poured out in cases of simple excitement, and the subsequent organization is also of the common kind; whilst, in other instances, we observe the deposited substance to be very various in quality, either not admitting of, or not acquiring organization. Again, in other cases, when organization takes place, we observe the structures produced to be very various in their appearances and nature, and thus monstrous growths are formed, such as had no existence in the original compages of the body. When such morbid growths occur in the different organs of the body, their apparent bulk becomes enlarged; but their natural structure and functions are diminished, and may ultimately be destroyed.

As we find the same sorts and varieties of growths taking place, from the same causes, in the midst of the common tissue that connects the various parts of the body, I was led to speak of Tumours, though, by this means, it became necessary to consider several diseases, which might, perhaps, with more propriety, have been reserved for discussion at a future period. Here, however, the natural connexions of subjects were so strong, that no artificial concatenation appeared so well adapted to fulfil the chief object of arrangement, that of preserving and displaying every fact relating to the subject.

I next described what I called irritative inflammation, of which there are many varieties, and they were briefly noticed. Erysipelas was separately spoken of, because we usually distinguish it as a readily recognized species of inflammation, allied in its nature to those of the irritative kind.

Lastly, I spoke of mortification as an event, like suppuration, peculiar to no individual disease, but a common termination to many. It is the result of simple weakness; of want of action; of excessive action; and of other causes; and consequently requiring a proportionate variety of treatment. On this subject, I could not forbear starting an opinion, which some may think whimsical, and others absurd, even before this critical and learned assembly. I asserted, that mortification was not unfrequently the result of nervous disorder in the affected part, and further affirmed that I was well acquainted with the family from which this disorder, with the subsequent alarming disease, was descended; that it was one of the numerous and dissimilar progeny of the common

parents of local diseases; that it was a short-lived bantling, engendered by the reciprocal and aggravating irritation of disordered states of the digestive organs and nervous system on each other. It therefore followed that local applications were of little avail in this species of mortification, and that the removal of the exciting causes were the chief means of procuring a diminution and ultimate cessation of such effects.

In various parts of the lectures, I endeavoured to impress a distinction between disorder and disease. In disorder, the vital energies of parts are impaired, or excited and disturbed, as is manifested by errors in their feelings and functions. Disorder may therefore be said to be nervous, and parts may thus perish without struggle or re-action; without inflammatory processes, or with so trivial a degree of them as could not, by itself, destroy vitality.

To support these opinions by additional evidence, I would direct your attention to what happens in a disordered state of the stomach. Are not its feelings and functions disordered? By feelings, I do not mean those of actual pain; there may be inquietude without the patient's observing it, though, in general, uncomfortable sensations are remarked, particularly if the attention be excited to them. In such a disordered condition of the stomach, are not the secretions deficient or vitiated: and is it not, therefore, incompetent to perform its functions? We now know, for of late it has been demonstrated, that secretion is regulated by the nervous energies. Am I not then warranted in asserting, that disorder is nervous, and that it is manifested by errors in the feelings and functions of the affected parts? Such a disordered state of the stomach as I now allude to, is also competent to induce sympathetic disorders in other important organs, and greatly and variously to affect all parts of the body.

Now here I beg leave to enquire, who first led the way in noting the various sympathies of the different organs and parts of the body? Was it not Mr. Hunter? Many of my audience may not know that three or four of his lectures were occupied in recording the different facts he had collected relative to such sympathies. They were arranged under heads, as sympathies of Life with Life; of Sensation with Sensation; of Action with Action; including all their changes and combinations. I candidly acknowledge the reflection which these lectures induced in my mind. How extraordinary a man, thought I, is this, who could bestow such sur-

prising labour on so hopeless a subject. I also candidly acknowledge that I now think, as probably the comprehensive and discerning mind of Mr. Hunter then perceived, that much good may eventually be derived from patient and accurate observation with respect to this subject. We find many disorders and consequent diseases arise from sympathy, and that the organ sympathetically disturbed, often suffers more than that originally affected. Yet its disorder may not be susceptible of cure by medical treatment whilst the cause remains. Our attention ought, therefore, to be directed in such cases to appeasing irritation, and giving tone and tranquillity to an organ of which the patient perhaps makes no complaint, but which is the cause of the more evident and important malady.

To me the philosophical turn of Mr. Hunter's mind is demonstrated by his caution; with all his facts relating to sympathy, he formed scarcely any general conclusions. He distinguishes it into the continuous, contiguous, and remote. The two former are readily explicable. Of the latter, I, who have less caution, or more facts of a certain description than Mr. Hunter might have possessed, do not hesitate to say, that when injuries or disease of limbs bring on fevers, delirium, convulsions, or tetanus, or disturb the feeling and functions of the digestive organs, that these effects are produced through the medium of the brain. Whether sympathies can take place in a more direct or less circuitous manner, may be proposed as a question which I should thus answer:—When organs are supplied from the same plexuses or ganglia, it is reasonable to suppose they may participate in each other's disorder; on this principle, the whole of the digestive organs might rationally be supposed to sympathize with one another, and also the whole of the organs contained in the pelvis: disorder of the stomach might be supposed likewise to affect the œsophagus, lungs, larynx, and tongue, in consequence of those nervous communications with which we are well acquainted. But it may further be enquired, can sympathetic feelings occur between parts where we have not been able to trace such nervous communications; or how do those strange sympathies occur, and become established in disorder and disease, which we never observe in health? To me it is evident, as it was to Mr. Hunter, that the stomach has a direct sympathy with the most distant parts of the body, and that the heart sympathizes with the stomach; but in what man-

ner such sympathies are produced, or how the morbid and irregular sympathies which occur in diseases are occasioned, we presume not to explain. Yet if Mr. Hunter's opinions of the nature of life be true, none of these facts can well be considered as surprising.

Disorder, which is the effect of faulty actions of nerves, induces disease; which is the consequence of faulty actions of vessels. There are some who find it difficult to understand how similar swellings or ulcers may form in various parts of the body, in consequence of general nervous disorder, and are all curable by appeasing and removing such general disorder. The fact is indisputable. Such persons are not so much surprised, that general nervous disorder should produce local effects in the nervous and muscular systems; yet they cannot so well understand how it should locally affect the vascular system. To me there appears nothing wonderful in such events; for the local affection is primarily nervous, and the vascular actions are consequent. Yet it must indeed be granted that there may be other circumstances leading to the peculiarities of local diseases, with which, at present, we are unacquainted. Disorder excites to disease; and when important organs become in a degree diseased, they will still perform their functions moderately well, if disorder be relieved; which, therefore, ought to be the alpha and omega of medical attention.

Such were the subjects I endeavoured briefly to explain during the preceding season. I have thus led you to the place where we stopped, and from which we are now to proceed. Previously, however, to our advancing, allow me to enquire, who first explained in a physiological and satisfactory manner the diseased processes I have referred to: the formation of abscesses; the secretion of pus; the intersticial and other growths; the causes and circumstances of mortification? Was it not Mr. Hunter? We now hear no more of those ancient metaphors, concoction and erosion, but we find all the morbid changes accounted for by the perverted action of the ordinary powers and structures of parts; clearly perceiving that the same powers and organization, which by their natural and common actions produce health and beauty of appearance, do, when perverted, occasion disease and deformity.

Again, too, when we survey the infinite diversity of local diseases, how can we express ourselves, but in the language

of Mr. Hunter, by saying, that they are the result of peculiar or specific actions? To explain my meaning with respect to this subject, I must request you to advert to the labours and opinions of preceding physiologists. Were they not looking for mechanical contrivances, to account for the peculiar secretions which different glands produced? Ruysch displayed the pennicillous, the stellated, and contorted arrangements (called the acinous structure) of the minute and probably secerning vessels of different glands. I also am persuaded that Mr. Hunter, when he put the pieces of talc within the tunica vaginalis of a ram, and withdrew them successively to ascertain how soon the secreted fluids acquired the puriform character, did, when he afterwards examined the parts, observe them with particular attention, in order to discover whether some peculiarity of structure had not preceded this peculiarity of secretion. Baron Haller, however, expressly asserts the opinion, that actions, living actions, have a great share in causing the peculiarities of secretions, and the changes we observe in them. But the direct proof of this fact remained to be exhibited to the public by Mr. Hunter. It was by observing the peculiarity of the local actions, and consequent secretions resulting from the application of different morbific poisons, that this subject was placed in a clear and distinct point of view. In such cases the same structure may be very variously affected, producing different forms of disease, and various kinds of secretions. I do not dwell upon the subject, because the facts and inferences have not as yet been laid before you.

I bring forward Mr. Hunter's opinions on these subjects, at present, merely to shew what notions we are warranted in forming, relative to the causes of such an extreme diversity of local affections, either of an inflammatory or other character. If actions can be peculiar and specific, if the effect of them can be that of producing various forms of disease, and qualities of secretions, when such actions are excited by peculiar stimuli; is it not probable that the actions which occur in parts, the feelings and functions of which are disordered, may spontaneously assume a peculiar character, and thus give rise to the diversity of diseases? We have, as I shall afterwards shew you, in some cases positive evidence in proof of this proposition.

Now when the terms specific and peculiar actions were employed by Mr. Hunter, to designate facts which have not

and as I believe cannot be otherwise expressed, persons, who seem to me to employ their minds rather in preventing than in promoting the progress of science, who object to every thing new, and suggest nothing, boldly asserted them to be absurd. They sagely observed, it was impossible that there could be any peculiarity of action; because vessels could only act more or less forcibly or frequently. Now when Mr. Hunter makes use of the phrase peculiar action of vessels, I am sure he meant more than he expressed, and employs it only on account of brevity. For he thought that life was the cause of the actions of vessels; that it pervaded the fluid blood, and the gelatinous and albuminous solids; that it built up the very organization by which it effected its subsequent functions; that the life of vessels could modify their contents; that life was the cause of the various secretions, and the forms and phænomena we observe both in health and disease.

I am persuaded Mr. Hunter's notions of disease cannot be apprehended, unless his opinions respecting life be previously understood; and therefore did I deem it necessary, in the first place, to endeavour to explain his doctrines on that subject. There is an obscurity in his writings, and his meaning cannot always be perceived, unless by that kind of illumination which is derived from a continual reference to his elementary opinions concerning vitality. With such elucidation, it may be discerned that in the lectures I last year had the honour of addressing to you, I did little more than deliver Mr. Hunter's opinions respecting diseases. Surely, he must have been a strong and clear sighted man, to see so far through obscurity; for, till very recently, no light had ever shone upon these subjects: but of late the vital functions have been so far illuminated, that any one who pleases may see that Mr. Hunter has pourtrayed them, both in health and disease, with a distinctness and accuracy highly creditable to his penetration and discernment.

It seemed to me proper on this occasion to review the subjects which engaged our attention during the preceding year, to lead you to the point where we stopped, and from which we are to proceed. Yet this review has occupied so much time, that I fear I cannot to-day finish even one of the subjects next in succession; besides, I suspect it may have disqualified both myself and my audience from paying that close attention to them which is required in order to understand

them. There is no class amongst the students of nature that ought more particularly to attend to the advice of Bacon, than that of surgeons :—To look closely and intently at the subjects they are engaged in examining, in order to discern what nature may perform or endure. Yet when the eye has been long employed in viewing distant objects, it does not speedily regain its myoptic powers, and adapt itself for such a scrutiny as we are next to take. I am, therefore, induced still to detain your attention to general topics.

The works and writings of Mr. Hunter have now been long before the public, so that all may be supposed equally qualified to form their own opinions of his merits; and pertinaciously to persist in eulogizing his character, may seem like arrogating to myself a power of judgment, and denying it to others. It is, however, the opportunities I have possessed that have been the cause of the peculiarity of my sentiments and opinions; for I am old enough to remember the state of surgery and surgeons in this metropolis, previous to the general promulgation of the new facts and opinions he added to the stock of professional knowledge, and I believe him to be the author of a great and important revolution in medical science: of this I am certain, that his works produced a complete revolution in my mind. Can I then do otherwise than acknowledge it? If I have to deliver facts and opinions which I am conscious I derived from another, can I appear before any audience, either of students or brethren in the profession, like the vain daw, decorated with another's plumes, and liable to be detected and convicted as the very worst of pilferers, the purloiner of another's reputation? I should be ashamed on any occasion to feel either reluctant or afraid to render honour and praise to whom they are due; and in my opinion they are eminently due to Mr. Hunter.

Believing Mr. Hunter to have possessed that rare combination of qualities, which, whenever it occurs, constitutes an eminent character,—I mean genius, reflection, and industry; and that he has made a most important revolution in science; I cannot but regret the obscurity and intricacy of his language, which prevents his merits from being duly appreciated. I have furnished you with the only clue I know of to guide you through the labyrinth.

There are some who possessing great powers of reflection and accuracy of judgment, yet from deficient knowledge of language, and of the generally received or adopted modes of

forming opinions, or from not paying attention to the processes of their own minds in forming conclusions, are unable to explain their thoughts to others. I am ready to grant that there is an obscurity in Mr. Hunter's writings, the result even of perplexity of thought. I know not how I can express my notions of the cause and effect of this obscurity more briefly and clearly, than by a kind of metaphor I have been accustomed to use on this occasion. The products of the fermentation of that mixture of knowledge and talent, which there was in the mind of Mr. Hunter, seem to me to have been completely formed. Yet the mass still remained in commotion, and sufficient time had not elapsed to allow of those products becoming perfectly clear. If I have not overrated the value of such products, I may urge some claim to approbation for having carefully collected and filtered them; to express my meaning without metaphor,—for having sedulously endeavoured to make out Mr. Hunter's opinions, and tried, at least, to express them more distinctly. I heartly wish, indeed, that his opinions had met with a better expositor; for I, like him, have been an unpremeditated author, who never learned the art of literary composition.

May I, however, venture to suggest another reason why some do not understand Mr. Hunter? If we wish to learn what another thinks, we must dispose our minds to receive instruction in the very manner it may be conveyed to us. We must relinquish, for a time, all attention to our own opinions, in order to learn those which are to be communicated. The same processes of mind must be gone through, or the same results cannot be obtained; we must follow in exactly the same steps, or we shall never arrive precisely at the same point. It is a very ancient observation, that self-conceit opposes a constant and sometimes an insurmountable barrier to instruction. "Seest thou a man wise in his own conceit, there is more hope of a fool than of that man." Under the influence of these considerations, I do not wonder that young men, who will not take the pains necessary even to learn what Mr. Hunter thought respecting life, should be unable to understand his general writings, and suppose others to be as incapable as themselves.

I should not doubt of being able to induce any one, who had previously no decided objection, to think as I do respecting Mr. Hunter. Only a few of the facts on which I found

my opinion of his character are at present before you; you must know them all, ere you can think and feel exactly as I do. Conscious that I may tire, nay even displease you, by thus obtruding my individual sentiments, resolving never to trespass on your patience in the same way again, but hereafter undeviatingly to pursue the regular and beaten path of sober tuition, may I now claim your indulgence for a short time, whilst I advert to some other subjects, in which Mr. Hunter has done our profession and mankind in general important service.

When the description of the inflammatory diseases is concluded, the next subject that will engage your attention is that of diseases which the absorbing vessels are principally concerned in producing. To detach all the facts and opinions of Mr. Hunter relative to this subject from the different parts of these lectures, and to review them, at present would be tedious and unprofitable; suffice it then to say, that in perfecting the knowledge of the physiology of the absorbing vessels, all nations allow great merit to the English. On this ground even the French seem to admit the triumph of English physiology. But by whom were we led on to this victory? By whose personal exertions was the laurel won? Surely by Mr. Hunter.

In the next succeeding subjects,—the diseases induced by the action of poisons on the animal frame,—when I consider the number and importance of the facts first noticed, and the inferences first drawn by Mr. Hunter, together with the consequences which have resulted from them, I must regard him, even if he had done nothing else, as a most important benefactor to our profession, and to the public.

I shall advert to no other subjects, but merely add, that there is one sentiment which ought, I think, to attach every English surgeon to the memory of John Hunter; it is that *esprit de corps* which belongs to all associations of mankind. We should be grateful to him, for he has exalted us, he has dignified our profession. Baron Haller commenting on the character and conduct of surgeons in general, expresses his surprise that no one has been particularly eminent in that profession.* To me it would have been surprizing had it

* In chirurgicis, nescio quomodo factum est, ut vix unquam perinde ut in aliis medicinæ partibus magnis aliquis vir eminuerit, qui late posteros sequaces habuerit.

(Bibliotheca Chirurgica Init. tom. 2.)

been otherwise, considering the debased condition into which the profession had sunk, and in which it had remained for ages. I admit, that surgery was gradually rising, and would eventually have obtained its proper level amongst sciences; when Mr. Hunter suddenly raised it to its present elevated situation, from which it can never be removed.

Mr. Hunter became a physiologist; and to become such a physiologist as he was, it was necessary that every variety of structure and of function should be surveyed in every variety of living being; that nature and nature's laws should be examined with the most minute attention, and upon the most extended scale; that parts should be observed with microscopic scrutiny, and yet that comprehensive views should be taken of the whole. Afterwards, with the enlightened eye of a physiologist, he surveyed the perverted actions of living bodies in the production of diseases.

Thus did he make surgery a science. It is the knowledge of health that enables us to understand the nature of disease. He connected pathology with physiology; and it is impossible in future ever to disjoin them. He raised a solid and permanent pillar of physiology, and he placed surgery on the top; where it must ever remain, equal in rank and elevation to any other science, perhaps superior in utility to all. By so doing, it may, I think, with truth be affirmed of him,

> ——opus exegit, quod nec Jovis ira, nec ignes,
> Nec poterit ferrum, nec edax abolere vetustas.

There is no path to scientific improvement in our profession, but that which Mr. Hunter trod. It is the path of physiology. It is now fairly laid open to you. He has been your pioneer. Enter; and in proportion as you pursue it with vigour and constancy, so will you arrive at knowledge, and obtain renown. Do this; and it is certain no future Haller will have cause to express surprize, that Surgeons have been undistinguished characters in the medical profession.

PHYSIOLOGICAL LECTURES,

EXHIBITING

A GENERAL VIEW

OF

MR. HUNTER'S PHYSIOLOGY,

AND OF

HIS RESEARCHES

IN

COMPARATIVE ANATOMY.

DELIVERED BEFORE

THE ROYAL COLLEGE OF SURGEONS,

IN THE YEAR 1817.

BY

JOHN ABERNETHY, F.R.S. &c.

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TO

THE RIGHT HONOURABLE

SIR JOSEPH BANKS, BART. K.B. &c.

DEAR SIR,

To you, the Patron and Friend of John Hunter, I dedicate this inadequate attempt to delineate his character and labours.

Permit me at the same time to assure you of my great respect, and also of my gratitude for various acts of friendship and kindness which you have conferred on me.

I have the honour to be,

DEAR SIR,

Your much obliged and obedient Servant,

JOHN ABERNETHY.

PHYSIOLOGICAL LECTURES

IN THE YEAR 1817.

LECTURE I.

AFTER resolving to write no more lectures, nor longer to praise Mr. Hunter, I break this resolution; yet my conduct seems to need no apology, for if my first decision was wrong, it is creditable to retract it; and if I am now wrong, it is probable I shall soon discover my error, the candid acknowledgment of which, would then be far better than ingenious excuses.

I have praised Mr. Hunter for his Theory of Life, because it is a probable one, cautiously and philosophically deduced, and adequate to explain the phænomena. Therefore am I directed by the precepts of philosophy, and also induced by other reasons, which I have partly explained in my first Lectures, to uphold it as a good theory, till a more satisfactory one be discovered. I have praised him, because his perception of the healthy state of the vital processes, enabled him to discern and investigate, the causes and effects of disorder and disease, in a manner and degree that have produced a most important revolution in medical science. I now mean to praise him for the great labour of his life, his Museum; which I may call the principal record of his deeds and opinions.

Hitherto I have endeavoured to make the Anatomical Lectures subservient to the surgical subjects I had afterwards to discuss. Finding myself rather at a loss for such topics, particularly because this theatre is unsuited to anatomical demonstrations, it occurred to me, that it might be useful to represent to my present audience, what were the peculiar improvements Mr. Hunter made in Physiology, and also the degree of perfection to which he brought that science.

No study can surely be so interesting as Physiology.—Whilst other sciences carry us abroad in search of objects, in this we are engaged at home, and on concerns highly im-

portant to us; in enquiring into the means by which we live, and move, and have our being. To those however, engaged in the practice of medicine, the study of Physiology is indispensable; for it is evident that the nature of the disordered actions of parts or organs can never be understood, nor judiciously counteracted, unless the nature of their healthy actions be previously known.

The study of Physiology, however, not only requires, that we should investigate the nature of the various vital processes carried on in our own bodies, but also that we should compare them with similar processes in all the varieties of living beings; not only that we should consider them in a state of natural and healthy action, but also under all the varying circumstances of disorder and disease. Few, indeed, have studied Physiology thus extensively, and none in an equal degree with Mr. Hunter. Whoever attentively peruses his writings, must, I think, perceive that he draws his crowds of facts from such different and remote sources, as to make it extremely difficult to assemble and arrange them.

I am the more particularly induced to follow Mr. Hunter through the separate examination of the principal vital functions, because I know his notions of life were deduced from considering them severally and conjointly. I hope therefore to be able, by such an examination, to convince you of the truth of his opinions on that subject; for I hear there are some who still say they think them either unintelligible, or inadmissible. If these opinions be not understood, his works, I am persuaded, will remain obscure. They seem to me like writings in a cypher; his notions of life forming the only key by which they can be intelligibly read. Yet, to examine the vital processes, as Mr. Hunter has done, it is necessary to refer to the facts contained in his Museum; and to commemorate his labours as a comparative anatomist, which it is particularly incumbent on some of us to do; for so little have they been revealed to the public in general, that even Professor Cuvier has declared, he knew not that there was such a collection as the Hunterian Museum.

To display the talents and labours of Mr. Hunter in forming his Museum, it seems proper, in the first place, to notice those circumstances which led to this great undertaking: for great indeed must it be accounted, when it is considered, that it was accomplished by the labour, and at the expense, of an individual. Mr. Hunter was the first in this country, and I believe I may say in any country, who studied Comparative

Anatomy and Physiology extensively, in order to perfect the knowledge of our own animal economy. I admit, indeed, that Baron Haller was fully apprised of the advantages likely to result from this proceeding, and that he himself had prosecuted the same mode of enquiry, to a certain degree. I am also aware, that many men may have explored the structure and functions of particular tribes of animals even more fully than Mr. Hunter himself has done. I am aware, that when the Count de Buffon engaged in his work on natural history, he might have excited Daubenton to a general investigation of the structure and functions of all the varieties of living beings; and that Professor Pallas might have followed the steps of Daubenton, and traced the subject generally and extensively. But I am not apprized that any systems of Comparative Anatomy and Physiology were published before those of Professors Blumenbach, and Cuvier. Neither can I believe it possible, that such enlarged and interesting views of the structure and functions of living beings in general, could have been formerly contemplated and not displayed by any man except by Mr. Hunter, who experienced such great difficulty in communicating what he knew, was never satisfied with the extent of his knowledge, and who cultivated Physiology, only as preparatory to the still more important science of Pathology. Of late years, many persons have engaged in the study of Comparative Anatomy and Physiology, and they seem to feel like the discoverers of a new path in science, which they pursue with animation and energy, as promising to lead them to some advantageous and commanding situation, from which they may eventually discern the whole order and course of nature in the most interesting part of her works, the formation and functions of living beings. Yet this is the very path which Mr. Hunter trod, unobserved, and in silence, with constant and accurate observation, and profound meditation. It is but just, that some one should say how far he had proceeded, and what were the general results of his observations and enquiries.

Mr. Hunter came to London in the autumn of the year 1748, and was educated to anatomy, during ten years, in his brother's dissecting room. In that time, he made many important discoveries in the structure of the human body, and his attention, from a very early period, being directed to

Comparative Anatomy, we find him subsequently asserting, that among other researches in this department, he had in the same interval made preparations of the organ of hearing in fishes, of which he claimed the discovery. Mr. Hunter's biographer, Sir E. Home, mentions, "that his desire to obtain a correct knowledge of the functions of the organs in the human body, first led him to examine the same kind of organs in various animals."

From his brother's elegant and learned lectures, Mr. Hunter must have derived the best physiological information of the time; the facts and opinions of every writer, collected, arranged, considered, and improved by the industry and talents of Baron Haller, together with whatever later discoveries or suggestions had been made in that department of science. When he went abroad as an army surgeon in the year 1760, he had an opportunity of acquiring a knowledge of the animal productions of other countries, and of their surrounding seas. But he had neither time nor opportunity for the collection and display of those facts which doubtless he constantly accumulated. He returned to England, his mind teeming with knowledge, and full of great designs; determining to display the structure, and investigate the functions of living beings in general, both in the states of health and disease. With what extreme and unabating industry he wrought at this great work, his biographer has also told us; he allowed himself but five hours daily rest, during the remainder of his life. His mornings were passed in the Museum, and his days in constant experiments and dissections.

His object in forming the Museum was simple; it was to display the anatomical facts which were the ground-work of his physiological opinions; to exhibit the visible means, by which the vital processes were carried on, in all the varieties of living beings, that came within his cognizance. Mr. Hunter's biographer has told us how anxiously he sought for sources of knowledge. In 1782, Mr. Hunter says, his Museum "had already cost him 10,000*l.* besides the labour required in making the preparations. Of this sum more than 2000*l.* had been expended in the purchase of dead animals only."* Opportunities of examining rare and curious animals were also liberally afforded to him, chiefly through the means of that zealous patron and promoter of science, Sir Joseph Banks; towards whom, he always felt and expressed

* European Magazine for 1782.

the warmest friendship and gratitude. Mr. Hunter knew but little of the arbitrary arrangements of natural history. The simplicity of his object induced an equal simplicity of arrangement. The facts are displayed in his Museum, according to the order of the vital processes, which is the method also adopted by Professor Cuvier.

I repeat what I asserted in the introductory lectures, that the preparations in the Museum are records of facts. Mr. Hunter would have given his money even to his own ruin, to have procured the evidence of any fact warranting an important physiological conclusion; but he admitted nothing into his collection foreign to its general design; and scarcely any thing but of intrinsic value is to be found amongst the real gems in his cabinet. We do not over-rate the value of his preparations, in comparing them with the paintings of an ancient master, which are of high price because they possess a peculiarity of excellence that cannot be equalled. Every object shown by Mr. Hunter is displayed with a kind of elegance, as well as with distinctness and truth. He was not a man of learning, and derived but little assistance from the labours of others. Few perceived the ultimate objects of his pursuit. His inquiries into the structure of the lower kinds of animals, were regarded as works of unprofitable curiosity, and no one felt an interest in them. Therefore, without the solace of sympathy, or encouragement of approbation, without collateral assistance, did he labour to perfect his designs, till death deprived us of so great a benefactor to mankind: an event which happened on the 16th of October, 1793.

In the autumn of the year 1776, Sir Everard Home informs us, that "Mr. Hunter was taken extremely ill, and the nature of his complaints made his friends as well as himself, consider his life to be in danger. When he reflected on his own situation, that all his fortune had been expended in his pursuits, and that his family had no provision but what should arise from the sale of his collection, he became very desirous to give it its full value, by leaving it in a state of arrangement." He therefore was anxious to have a catalogue made, and wrote a little preface to each department of his Museum. These explanations of his designs ought not, in my opinion, to be published; for they appear to be mere sketches of what he meant in future to have finished. To

these writings, however, I shall frequently refer, because they show the extent of his knowledge and views at that time; which was more than 20 years prior to the publication of Professor Cuvier's lectures. On his recovery from this severe illness, his time was however occupied in increasing his knowledge, and not in recording what he had obtained; and his catalogue no longer seemed the important object his illness had made it appear. Considerations, deducible from the imperfect state in which he left his Museum, probably influenced his last act; for he would not suffer it to be sold unless altogether; doubtless anticipating, that when it was examined as a whole, his designs and his labours would be fully appreciated. In the pursuit of knowledge, he relinquished that of wealth, so that he left his family no other legacy than his Museum; which, after the lapse of several years, was bought by Parliament, and given to this college. Mr. Hunter's Museum has thus become our Museum; and I trust that every member of this college will feel that interest in it, which is commonly felt for things appertaining to ourselves. Belonging to a commercial nation, we visit every part of the world; and have opportunities of bringing home whatever is rare and curious in Comparative Anatomy.—But to know the wants of the Museum, it is necessary that we should know what it contains, and also the general desiderata in this department of science. The latter may be learned from the systematic books lately published, and both will be shown by the lectures of my brother professor, whose extensive and accurate knowledge of Comparative Anatomy, as well as of other subjects connected with medical science, cannot but greatly redound to the credit of his industry, comprehension, and capacity.

Gratitude to the former of the Museum, and also to the donors of it, equally demand that its value and excellence should be publicly acknowledged and displayed; which consideration has goaded me on to undertake and imperfectly to execute a task, for which I feel myself not properly qualified. It is my design, on the present occasion, not only to show you what were Mr. Hunter's opinions respecting the principle vital processes, but also briefly to exhibit the extent of his knowledge in Comparative Anatomy, and to contrast it with that promulgated of late years by Professor Cuvier. I

candidly acknowledge, however, that I have little acquaintance with the subject, except what I derived from looking over the preparations in the Museum, from reading Professor Cuvier's lectures, and from the frank and friendly communications of our highly praise-worthy conservator, Mr. Clift. Permit me to say, gentlemen, though many may know it already, that Mr. Clift resided with Mr. Hunter, and was taught by him to exhibit anatomical facts in preparations; that he does credit to his excellent instructor; that he feels the same interest and zeal that his patron did for the improvement of this department of science; and that he possesses the same candour and simplicity of character. I am, however, aware that I may have attended chiefly to one side of the subject, and that my partiality to Mr. Hunter, may a little mislead me; I wish you, therefore, no further to confide in what I say, than as I confirm my assertions by facts; and to regard me, on this occasion, in the light I appear to myself, as one venturing to come forward a voluntary advocate in the cause of Hunter versus Cuvier and others, and in this character I may thus address you.

Gentlemen, (of the Jury,) I trust I can prove to your perfect conviction, by ample and incontrovertible evidence, that my client died seized and possessed of very considerable literary property, the hard-earned gainings of great talent and unparalleled industry. It is not, however, for the property that I plead, because that is already secured; it is fenced in, landmarks are set up, it is registered in public documents. I plead only, for the restitution of a great and accumulated income of reputation, derivable from that property; which I trust you will perceive to be justly due, and will consequently award to my client and his country. In mentioning our country, think not, that pleader-like, I wish to bias your judgment. Self-love, or nationality, which is but an extension of the same sentiment, is only productive of good when it excites emulation; and on this account alone, would I ever advert to it in the cause of science. Nation should vie with nation in promoting human knowledge and happiness. A desire to obtain the respect of others may warrant us in claiming our due; but we should freely accord to them that tribute of respect and applause to which they also are entitled.

I cannot easily express the gratification I received from reading Cuvier's Lectures on Comparative Anatomy, because, in addition to the information I derived from them,

they enabled me clearly to discern the extent of Mr. Hunter's views. Neither can I tell the regret I felt that such a book had not been published during the life of Mr. Hunter, that he himself might have compared the opinions derived from more general and extended observation, with those that had resulted from his own peculiar modes of enquiry and consideration.

In praising Hunter, I by no means wish to disparage Cuvier; on the contrary I acknowledge the industry with which he has collected information by reading; and the great additions he has made to the stock of public knowledge relative to the subjects on which he treats. I admire, also, his clear arrangement, and the genius which is displayed throughout his works. We observe a constant endeavour to discover the series and order of facts,; the variety of means employed for effecting the same purpose; attempts to reduce a number of facts to one general principle; in short, the endeavour to discover the causes and nature of whatever we observe; the hope of effecting which, appears to be the most potent incentive to labour, and the accomplishment its most gratifying reward. To shew that Cuvier has not wrought so hard without some animating motive, I quote his own words. "Pourquoi tel animal ne se nourrit-il que de chair, tel autre que de vegetaux? D'o'u celui-ci tire-t-il la finesse de son odorat, o'u celle de son ouie! D'o'u vient que l'oiseau voit egalement bien a' des distances si differentes? Quelle est la source de la force prodigieuse des muscles des oiseaux? Cette force comment est elle employe'e 'a produire ce mouvement si e'tonnant du vol? Quelle est la cause de l'e'tendue, et de la variete' de sa voix? Tel reptile, pourquoi est-il si engourdie? Tel ver, comment conserve-t-il la vie long tems apres etre divise'? Tel zoophyte comment peut on vivre egalement bien quelque parties de son corps que l'on en retranche. Suppose-t-on qu'il puisse exister une histoire naturelle sans ces questions, et des milliers d'autres semblables?"

Believing that no man will ever labour in the strenuous and unremitting manner that Mr. Hunter did, and to the detriment of his own private interest, without some strong incentive; I have supposed, that at an early period he conceived those notions of life which were confirmed by his future enquiries and experiments. He began his observations on the incubated egg, in the year 1755, which must either have suggested or corroborated all his opinions with regard

to the case of the vital phænomena. He perceived that however different in form and faculty, every creature was nevertheless allied to himself, because it was a living being; and therefore he became solicitous to enquire how the vital processes were carried on in all the varieties of animal, and even vegetable existence. In the progress of science, genius, with light and airy steps, often far precedes judgment, which advances slowly, and either finds, or forms a road along which all may proceed with facility and security; but the direction of the course of judgment is often suggested, and its actions are excited and accelerated by the invocations of preceding genius.

Whether truth be discovered by that penetrating foresight which is characteristic of genius, or ascertained by the more laborious methods of experiment and induction, still, when it is once found, each succeeding observation serves but to convince us of its nature and reality. No one could be more scrupulous in admitting propositions to be proved, than Mr. Hunter; yet he was convinced that his opinions respecting life were true, by a course of patient and persevering meditation, on all its phænomena, in a manner I shall endeavour more fully to point out in the succeeding lectures. Yet these opinions, though correspondent to those of the wisest philosophers of ancient times, were so little suited to the modes of thinking of his contemporaries, that it required no small degree of hardihood, in a man of little education, to maintain them, in spite of the apathy or derision with which they were received by persons of greater general learning. Such, however, is the hardihood that conviction produces.

When, however, conclusions are deduced by a course of patient and persevering consideration of voluminous and multifarious evidence, it is scarcely possible to detail the causes and processes of thought by which we have been led to them: and this, I doubt not, made one of the difficulties which Mr. Hunter encountered, in communicating his opinions. By investigating the works of nature, we collect facts from which we deduce opinions. On the formation and importance of opinions, I have already taken the liberty of expressing my sentiments before to this assembly, to which I now beg leave to add, that there are many who think clearly, who do not think deeply; and they have greatly the advantage in expressing themselves; for their thoughts are generally simple and easy of apprehension. Opinions immediately deduced from any series or assemblage of facts

may be called primary opinions, and they become types or representatives of the facts from which they are formed, and, like the facts themselves, admit of assortment, comparison, and inference; so that from them we deduce ulterior opinions, till at length, by a kind of intellectual calculation, we obtain some general total, which in like manner becomes the representative and co-efficient of all our knowledge, with relation to the subject thus examined and considered. In proportion to the pains we have taken in this algebraical process of the mind. and our assurance of its correctness, so do we contemplate the conclusion or consummation of our labours with satisfaction; and being unable to display to others the different series of facts and opinions, and modes of inference, we express our certainty of the conclusion, by saying, it must be so; it is absurd to suppose otherwise; or, as they say Dr. Johnson was accustomed to do, "I know I'm right, so there's an end of it."

Now these ultimate opinions, for so I may call them, as being the last of a series, become primary and elementary in the display of knowledge. These conclusions of thought become principles of science and of conduct. By the prosecution of thought, we are led to observe the very trunk and roots from which the various ramifications of our knowledge are produced, and the nature of the ground on which the whole is supported, so that we become assured of its security, or admonished of its uncertainty. It is then, to certain ultimate opinions, or physiological conclusions of Mr. Hunter, with respect to the vital processes. that I chiefly wish, on the present occasion, to excite your attention; and these are highly important, on account of their re-action, and the bias they impart to our opinions in general, and also to our conduct.

The study of Nature has been compared to the working of an inexhaustible mine, abounding in rich materials; but which require to be assorted, refined, and wrought up, ere they can be converted to useful purposes. Some dig the crude materials from the mine, others assort and refine them; whilst others again, construct, with the wrought substances, instruments of great utility in the future acquisition of knowledge. Surely, I may be permitted to consider opinions as the instruments of intellect, for it both forms them and employs them in its future operations; and when also they are well constructed, they illuminate and render intelligible surrounding objects; but when ill formed, they only obscure

and disfigure the face of nature. In adverting then to Mr. Hunter's Museum, by thus circumscribing my designs, I shall not in the least trench upon the province of my brother Professor; for I shall not describe facts, nor detail opinions; I shall not examine the materials, but merely the construction and utility of certain instruments which the hand of Hunter either formed or finished.

When I first had the honour of addressing the members of the College in this theatre, I knew it would be expected that I should eulogize Mr. Hunter; and nothing loth, I declared that he seemed to me to possess that rare combination of intellectual powers which qualified him equally to extend the boundaries of knowledge and to establish principles of science and practice. Of his opinions, I said I knew of none that had not been cautiously and legitimately deduced from the facts before him, and though the progress of science might have since invalidated some, yet most of them, from the same cause, had become more and more firmly established. In proof of the latter part of this proposition, I excited your attention to his opinions respecting life, which the progress of science seems to me to have most perfectly confirmed. The probability of his opinions on this subject, is to be inferred from analogy; their rationality, from their adequateness to account for all the vital phænomena. As Sir H. Davy's experiments fully prove that electricity may be superadded to, and that it enters into the composition of all those substances we call matter; I felt satisfied with this establishment of the philosophy of Mr. Hunter's views, nor thought it necessary to proceed further, but merely added, "It is not meant to be affirmed that electricity is life. I only mean to argue in favour of Mr. Hunter's theory, by shewing that a subtile substance of a quickly and powerfully mobile nature, seems to pervade every thing, and appears to be the life of the world, and that therefore it is probable a similar substance pervades organized bodies, and is the life of these bodies." I am concerned, yet obliged to detain you by this recapitulation, because my meaning has been either misunderstood or misrepresented.

Mr. Hunter was the first physiologist who placed in clear array the various vital functions before our view, so as to enable us to judge of their nature and probable cause. He

told us that life was a great chemist, and even in a seemingly quiescent state, had the power of resisting the operation of external chemical agency, and thereby preventing the decomposition of those bodies in which it resided. Thus seeds may lie buried far beneath the surface of the earth for a great length of time without decaying, but being thrown up, they vegetate. Mr. Hunter shewed us that this chemist, Life, had the power of regulating the temperature of the substances in which it resides. Seeds possessing the principle of life being placed within the influence of the atmosphere, and in contact with moisture, produce heat, form sugar to edulcorate the first nutriment of the young plant, and in short, bring about all those phænomena which characterize incipient vegetation. He further shewed us, that Life, by its chemical processes, could convert a great variety of dissimilar substances, into one kind of generally distributed nutriment, and could also prepare from it a still greater variety of dissimilar substances. Mr. Hunter shewed us that Life was also an architect, that it built up a great variety of curious structures or edifices, in which it continued to reside and execute its future functions. No unprejudiced person can, I think, possibly doubt that it is by the active power of Life such effects are produced. Mr. Hunter shewed that the actions of life are various, that in nerves they are rapid, though not so forcible as in muscles. By such actions he accounted for the sympathies of remote organs, and the instantaneous effects produced on, and by the brain, from, and in the remotest parts of the body. He shewed that the most obvious, and in general most surprizing manifestation of vital activity, which is called irritability, was not necessarily connected with a muscular structure; and when apparently connected with the same structure, was subject to considerable variations in its actions. By means of the active powers of life, he also saw how it was possible that fluids should undergo those modifications, that are known to take place, from the affections of the vessels in which they are contained. Having convinced himself of these facts, he inferred that Life was a principle, active in all its functions, and that by acting in various modes and degrees it produced the diversified phænomena by which it is characterized.

I shall on the present occasion, add a few words, to what is contained in my former lectures, to shew the nature and probability of Mr. Hunter's opinions respecting Life, because I am unwilling to leave any excuse for saying, that they are either unintelligible, or inadmissible.

The progress of science, since Mr. Hunter's time, has wonderfully manifested, that the sun-beam when dissected by a prism, is not only separable into seven colorific rays of different refrangibility, producing the iridiscent spectrum; but also into calorific rays refracted in the greatest degree, or intensity, beyond the red colour, and into rays not calorific, refracted in like manner to the opposite side of the spectrum beyond the violet colour; and that the calorific and uncalorific rays produce effects similar to those occasioned by the two kinds of electricity; and thus afforded additional reasons for believing that subtile mobile substances do enter into the composition of all those bodies which the sun illumines, or its beams can penetrate. Late observations induce the belief, that even light may be incorporated in a latent state with animal substances, and afterwards elicited by a kind of spontaneous separation, by vital actions, or by causes that seem to act mechanically on the substance in which it inheres.* All the late discoveries in science seem to realize the speculations of ancient philosophers, and shew that all the changes and motions which occur in surrounding bodies, as well as in those which live, are the effect of subtile and invisible principles existing in them, or acting on them.

Mr. Ellis, who with such great industry and intelligence has collated all the scattered evidences relative to the production of heat in living bodies, and added so much to the collected knowledge, seems to think that all the phænomena of the variations of temperature in them, may be accounted for by known chemical processes. Here, however, I must observe, that Mr. Hunter's opinion of life having the power of regulating temperature was deduced, not only from his experiments related in the Philosophical Transactions, but also from observing, that in certain affections of the stomach, the heat of the body is subject to great vicissitudes, whilst respiration and circulation remain unaltered; and also that parts of the body are subject to similar variations, which appear inexplicable upon any other supposition than that of local nervous excitement or torpor, or some similar affections of the vital powers of the part which undergoes such transitions. His views with respect to this subject are confirmed by the late experiments of Mr. Brodie.† As the circula-

*See Dr. Hulme's and Dr. Macartney's papers in the Philosophical Transactions.

† Philosophical Transactions, 1811. Cronian Lecture.

tion of the blood will continue in warm as well as in cold blooded animals without the influence of the brain, provided respiration be artificially kept up in the former by means of a pair of bellows, Mr. Brodie severed the connection of the brain from the top of the medulla spinalis, which in effect instantly kills the animal, and thereby prevents further suffering in the experiment, and then maintained artificial respiration, and consequent circulation, for more than two hours. Yet under these circumstances the body cooled as rapidly and regularly as that of another animal in whom respiration and circulation ceased upon the division of the medulla spinalis. This experiment shews that the change produced by respiration on the blood is not of itself alone sufficient to maintain the ordinary temperature of animals. Chemical science has not yet explained how the intense heat and light are produced, which are occasioned by the transit of electricity through the air. That the powers of life regulate electrical actions is evident; and may they not in this manner produce some of those variations of temperature to which I have just referred? But admitting that the refined operations of modern chemistry should actually shew us the means by which the variations of temperature are in every instance produced, they would not explain the cause of those actions by which such means are rendered efficient; which actions constitute the essential difference between living and dead bodies.

Neither would chemical science, by explaining the regulation of temperature, unfold the cause of the other vital phænomena; for instance, the prevention of putrefaction and irritability. The heat of incubation would hurry on the putrefaction of a dead egg, but the white and yolk of a living one, which we cannot suppose to be organized, do not putrify, though they undergo changes subservient to the nutrition of the young animal they are designed to support. Doctor Macartney, who has of late particularly attended to this subject, gives it as his opinion, "that when fluids change their composition, it is often by some vital action in themselves, instead of a fermentative process, or the mechanical operation of solids upon them, as is commonly supposed."* Were irritability shewn to be an electrical phænomenon, and I consider it already demonstrated that they are electrical actions which cause the various combinations and decompositions so constantly occurring in all parts of living bodies,

*See article Incubation, in Dr. Ree's Encyclopædia.

and upon which their formation and functions so greatly depend; yet the consideration of the vital phænomena proves that such electrical operations are under the influence and control of the vital powers. I am aware that there is an obscurity in my first lectures, arising from my not explicitly declaring my sentiments; which did not then appear necessary, and even now may perhaps be deemed presumptuous and improper. In my opinion, experimental science has not as yet informed us of more than reason has suggested, from the consideration of the general phænomena of nature; which is, that the motions and changes occurring in surrounding bodies, and in our own, are the results of some subtile substance or substances, which enters into their composition, or acts upon them.

But if science were eventually to demonstrate that heat, light, and electricity, are different things, that there are various kinds of subtile substances, then I should be obliged to suppose that there was also a subtile substance belonging to living bodies, a principle of life, which had the amazing power of kindling and controlling the destructive element of fire, and regulating the actions of that still more sudden and powerful agent, electricity. Neither by so doing should I transgress the rules of philosophy; for in suggesting a theory, it should not only be probable, but adequate to explain all the phænomena. I am aware, however, that there may be some contemplative and unprejudiced men, who, perhaps a little elated by the progress of science, may think me hasty, and that I had better have waited to see what her ample page might have eventually unfolded. To them I bow with respect, and assure them, that I would have done so, had the subject been merely an abstract question in Physiology.

Few however are they who contemplate the nature of life "in the calm lights of mild Philosophy;" nor do I affect to include myself among that very small number. In becoming the advocate of Mr. Hunter's Theory of Life, I knew I should irritate what many might consider as a very formidable Party. Formidable, because some of them possess extensive information, are subtle disputants, have words at will to make the worse appear the better argument, and are writers even by profession. Yet I feared them not, because I knew, that words do not make, but merely adorn arguments.

Nevertheless I thought it prudent to entrench my subject behind a little fortification made of the most approved rules of reasoning; and neither this outwork, nor the subject itself, has even been assailed. Yet assertions have been made which I am concerned to feel it an indispensable duty publicly to answer in this place. I shall conclude all the individuals which compose this party, under a general denomination, which I think appropriate to them, and call them the Modern Sceptics.

First then, I am instructed, that I ought to consider life to be a property of certain structures, as gravitation and elasticity are said to be properties of matter. With this injunction, however, I cannot comply, because I can only think or consider in one way. I must deduce rational inferences from the facts belonging to any subject, or from analogies existing between that subject and others better understood. Now there is no analogy between the permanent and invariable properties of gravitation and elasticity, and the occasional and variable properties of life. Therefore, if I judge from analogy, I must think as I have hitherto done, that life is more like electricity or magnetism, because its operations are occasional; it may vary in degree, and admits of being annulled or abstracted, without evident difference in the subject to which it has belonged. My preceptors, suddenly shifting their ground, call upon me to consider life as an effect resulting from the combined action of certain structures. I own I am not disposed to follow such leaders, yet if I do, I discover that they wish me to consider life to be nothing; which I take to be the plain English of the Physiology contained in some late French publications relating to this subject.

When Sir Isaac Newton explained the laws of attraction, and of the motion of those substances we call matter; though he wished only to announce facts, without attempting to account for them, though reluctant to hypothesis, he afterwards felt obliged to suppose that there might be an æther, forming a bond of connection and reciprocal action between their distant masses and molecules. In the anatomical lectures which I have had the honour of delivering in this theatre, when speaking of the ultimate fibres of the body, I observed that they varied in the properties of rigidity, pliability, strength, and elasticity; and that such properties could not be considered to be dependent on the quantity of matter contained in the fibres, which would be estimable by weight, to

which such properties bear no proportionate relation; and, consequently, that these properties must be attributed to certain powers of attraction and repulsion operating in various modes and degrees, between the atoms of which such fibres are composed. However minute the atoms may be which compose those visible and tangible substances we call matter, Sir Humphry Davy's experiments shew, that each atom is surrounded by electric substances possessing powers of attraction and repulsion; and which substances are not only capable of acting upon the integral parts of bodies, but also upon the largest masses of matter. These electric substances produce decomposition and recombination, and by such means destroy the mechanical properties which had before obtained. Thus we see the toughest wood slowly decay, or suddenly consumed by fire.

So numerous are the phænomena in nature, that suggest and enforce the belief that subtile substances may and do pervade others more gross and inert, and produce effects in and upon them; that no surprise can be excited upon finding that contemplative men have in all ages adopted and inculcated this opinion. Yet it was not till of late years, by observing the phænomena of electricity and magnetism, that decisive evidences of this proposition were obtained. In considering these subjects, we observe the utmost boundaries of human knowledge, for all our information must be derived from our senses, which can never give us any cognizance of the atoms which compose surrounding bodies. Yet this horizon of our views has been always distinctly seen by long-sighted observers; and advanced as we are in knowledge, we can see no further. Persons of different characters of mind have thought, and may think differently; for neither can confute the other. One party, considering the more gradual and rapid changes which take place in surrounding bodies, and all the phænomena of motion and of rest, as effects of some subtile, invisible substance or substances pervading all nature, whilst the other may attribute them to inherent propensities in the atoms themselves.

I have led you thus far, Gentlemen, to shew you the rock on which the ancient fortress of scepticism stands erected, and it is evidently so unimpregnable that it has been a secure retreat for ages, and may still continue to be so. Whilst its tenants keep within their own territories, or even demean themselves peaceably abroad, I for one;

would never attempt to molest them, nor prevent them from the full enjoyment of their native apathy and inactivity of mind. But when they make excursions to annoy their neighbours, and in disguise too, it seems necessary to unmask them, and send them home again.

If, however, those professed sceptics, whom I have incorporated under the title of Moderns, really suppose that they have no opinion on certain subjects, they deceive themselves; for by repeatedly thinking that there may be nothing which is not an object of sense, they at last bring themselves to believe that there is nothing which is a positive opinion, and also a creed found to have various conveniences. Else whence arises their zeal to make proselytes and to refute the opinions of others, who, perceiving the deficiencies and fallibility of our senses, believe that there are many things far more demonstrable to reason than to sight.

Mr. Hunter's opinions may be denied, but cannot be refuted. It is, however, easier to maintain a proposition diametrically opposite to truth, than one originating in any intermediate degree of error. Those, therefore, who attempt to account for the vital phænomena upon any other supposition than the one I have had the honour of advocating in your presence, would lead us into such a maze of absurdity, that reason and common sense forbid us to follow them.

Now, in applying the philosophical opinions of the wisest men to account for the functions of life, according to the views which Mr. Hunter had taken of that subject, I have been charged with imagining causes of which Physiologists are not competent judges. It has been said, this is not on the record, nor before this court. You know, Gentlemen, that the plea of the incompetency of the court, is often urged when a party suspects a verdict may be given against them. If, however, Physiologists be not competent judges of this cause, no writ of *certiorari* to any other tribunal, can, I am convinced, with propriety be granted. I cannot but smile, when I hear or read of the functions of life being the effect of the vital forces; because the expression seems to me the very *ne plus ultra* of philosophical caution. So flimsy a veil is drawn before the subject, as not to conceal any thing; for every one is convinced that nothing can exert no force, and consequently that these forces must either be the attributes of the atoms which compose an organized body, or of some subtile and invisible substance superadded to, and inherent in it.

It has been said that Comparative Anatomy contradicts Mr. Hunter's opinions respecting life, for where there is no organ, there is no function. If nature did not design an animal to see, no eye is constructed; but how the want of an organ can affect the general question of what life may be, I am too dull-sighted to discover. It will be shewn, and I think it must be admitted, that life is an organ builder, as well as a performer on the instruments it constructs. That organization alone, does not produce the functions which belong to life, must, I think, also be granted. A man may sleep with his eyes open, and his friend stand before him with a light; yet, the organization of the retina does not enable the sleeper to perceive the image of his friend, though vividly depicted on its surface. Food may also be received into the stomach, and the circulation in that organ go on as usual, yet its organization does not cause digestion, unless vital actions regulate those electrical operations upon which the preparation of the food-dissolving juices of that organ depend. On the contrary, I may observe, that Comparative Anatomy informs us, the same vital processes of the prevention of decomposition, regulation of temperature, action, assimilation and growth are effected in structures extremely diversified: and further, that observations on disease demonstrate the perverted actions of the same structures to produce a great variety of effects, which is a proof that the actions of life do not depend merely on organization.

I will not condescend to particularize or parry the absurd attempts that have been made to ridicule Mr. Hunter's Theory of Life. I will only inquire, why we are to be prohibited from thinking, if we conform to the most approved rules of ratiocination? Why these sceptics try to ridicule what they cannot refute? and whence arises the irritability they have displayed? The nature of this kind of irritability is, indeed, well known to Physiologists, it is but the common consequence of debility when excited. But what is the exciting cause, what provocation has been given to them? It must be as I surmised; they have opinions and are irritated at any thing contradictory which they cannot oppugn. The very term of superaddition is discordant to their ears; the supposition that there may be any thing which is not an object of sense, or actual demonstration, torments them; they themselves perceive, that the superaddition of life to structure may, indeed, warrant the supposition of a sub-

stance having the properties of perception, and volition being superadded to life; and that there may be "more things in heaven and earth, than they in their philosophy dreamt of." Should such opinions gain ground, the privileges of scepticism seem endangered; their proselytes may no longer receive with perfect confidence the assurance of philosophical liberty, the assurance that, because they are sensitive and rational creatures, true philosophy, therefore, consists in gratifying their senses, and acting as their reason dictates, for their own advantage, independently of all other considerations. Wherefore do they tell us, that we know not why a muscle acts, or a nerve feels, and that both are properties of organization? Is it not because they wish to persuade others, as perhaps they may have brought themselves to believe, "that when the brains are out, the man is dead?" Yet surely, it does not necessarily follow, that perceptivity and consciousness are annulled, because those actions have ceased by which they have hitherto been affected or manifested.

I have heard it said that I was wrong in bringing forward a metaphysical subject before this assembly; yet no one can, I think, account Mr. Hunter's Theory of Life to be metaphysical; for we infer no more than we do with respect to electricity, that it is equally probable there is an electric fluid and a vital principle. Permit me to repeat, that I excited your attention to the consideration of this subject, not only because it affords a strong proof of Mr. Hunter's genius and reflection, but because I felt assured, that without understanding his opinions respecting life, no one can understand his general Physiology, or that Pathology which it was my principal duty and desire afterwards to explain. He seems to me to have written under a persuasion that others knew what he did respecting the vital functions, and had thought as he had done, and his merit as a Physiologist, has therefore been less generally perceived from the want of this previous information and reflection.

What Mr. Hunter thought about sensation I know not; what I think, I willingly declare, which is, that it can be neither the result of organization, nor an affection of mere life. In reasoning on the motions of the matter which surrounds us, and also of that of which we are composed, we must grant either that the atoms are motive, or that they are impelled to move. So also in reasoning with respect to sensation, if the atoms be not sentient, it is impossible

to suppose that sensation can result from the arrangement or motion of insensible atoms.

If to think and act in this manner be considered as an error, I must be shown that it is one, before I can alter either my opinions or conduct. Till then, I shall glory in entertaining the same opinions as Pythagoras, Plato, Socrates, and a host of others whom I need not mention, have done. It will be my boast and future endeavour to show by Physiological arguments, that in this instance also, what has been perceived by the penetrating eye of intellect, on a distant and general observation, becomes more and more apparent on a close and accurate examination of the subject. I say, it will be my boast, because I know that the opinions I allude to are productive of nothing but good to humanity, individually and collectively. I admit, that the belief that man is a machine does not tend to alter his natural and established motions, and consequently, that there have been many good and moral sceptics. But I also know, that the good dispositions will want that excitement and energy which the opposite sentiments produce, whilst the bad will be left without control. It is equally apparent that the belief of the distinct and independent nature of mind, incites us to act rightly from principle; to relieve distress, to repel aggression, and defend those who are incapable of protecting themselves; to practise and extol whatever is virtuous, excellent, and honourable; to shun and condemn whatever is vicious and base; regardless also of our own personal feelings and interest, when put in competition with our duty.

We all seek for truth, and on her approach, and in her presence, are ready to sacrifice, without hesitation or reluctance, our most favourite opinions;—but to exchange opinions for other opinions, as in this case seems required of us, when the barter is so disadvantageous, would be the highest absurdity. We should give up that which is in every respect, and in the greatest degree, useful and dignifying, and what experience has proved to be durable, for that which is pernicious and derogatory, and which evidently cannot last; for the specimens presented to us are composed of such flimsy and ill-connected materials, that they will not bear even common handling and examination.

Whoever considers the operations of intellect, will, I think, perceive, that when conviction is not forced upon the mind, by something resembling mathematical demonstration, we form our own opinions. We think as we have been instruct-

ed to think, or as those do with whom we associate. Thoughts become concatenated, and by repetition habitual and established. There is a strongly imitative or gregarious disposition, even in intellect; most people think as well as act with a party, and hence results the good or evil derived from association. That in France, in a nation where the writings both of its philosophers and wits have greatly contributed to demoralize the people, I do not therefore wonder that those of their anatomists and physiologists should represent the subject of their studies in a manner conformable to what is esteemed most philosophical or clever. But that in England, the chief excellence of whose inhabitants is, that they are a thinking people, who consider the probable ends of conduct from its beginning; that in this country, particularly after so arduous an examination, and so rational an explanation of the vital phænomena have been presented to us by Mr. Hunter, the mere opinions of some French anatomists, with respect to the nature of life, should be extracted from their general writings, translated, and extolled, cannot, I think, but excite the surprise and indignation of any one fully apprized of their pernicious tendency.

The education and course of life of medical men tend to make them sober-minded, moral, and benevolent; and their professional avocations equally require, that they should possess such characters and dispositions. On no other terms can they be admitted with confidence into the bosoms of those families which may require their medical aid. Whoever therefore inculcates opinions tending to subvert morality, benevolence, and the social interests of mankind, deserves the severest reprobation from every member of our profession, because his conduct must bring it into distrust with the public.

If what I said in the introductory Lectures has irritated the party of Sceptics, what I now say, may anger them still more. But I fear them not; they can only shoot at me with the shafts of ridicule, or spit at me the venom of their malice; both of which modes of assault I actually laugh at; for the experiment has been tried, and I know, that though these things may tickle, they can never annoy me. To express my opinions on this subject a little technically, I may say, such means have no effect upon sound or naturally defended surfaces; some point must be exposed, or morbidly susceptible, ere they can occasion either pain or irritation. If, however the Sceptics had ever the power to injure me, still I

should not fear them; because I place between us the undisguised truth, which they can neither conquer nor confront. For truth possesses a power which poets have represented by symbols; like the Ægis of Minerva, or the spear of Ithuriel, it has the power, not only of protecting and maintaining what is right, but of revealing, abashing, and appalling, what is wrong.

LECTURE II.

THE propensity to observe and compare surrounding objects, seems natural to man. We find even children pleased with examining and assorting stones, spars, metals, and other specimens of mineralogy; still more gratified with those beautiful objects, flowers; and even in a greater degree with moving beings, which, on that account, claim a kind of alliance with themselves. Yet so diversified are the subjects of nature, in each of these departments, that it requires the constant application of any individual to render himself a distinguished character either as a mineralogist, a botanist, or a zoologist. Linnæus, whose knowledge of natural history was so extensive and exact, perceived the necessity of some system of mnemonics, by which we might remember and survey the whole. He therefore formed an arbitrary arrangement of these subjects, and chiefly from their external characters. The advantages resulting from this plan were striking. It was perceived how we could thus learn parts in detail, and also contemplate the extreme diversity and extent of the system of nature; as well as how we might arrange any additional knowledge that was obtained, so as to make it a part of one orderly whole.

The minds of men seem to have been fascinated by the method which Linnæus had adopted; for it was applied to subjects where no artificial memory was required. Even diseases were thus arranged; and the attention being directed to their external characters, it was taken from its true object, which should be to enquire into their intrinsic nature. This is a striking though not singular instance, showing, that even grave and learned men, reputed philosophers, have a

propensity, like sheep or like school-boys, inconsiderately to follow the leader.

That the arrangement of Linnæus is unnatural, and unsuitable to the purposes of Comparative Anatomy, is evident; but we need not defame the memory of so great a contributor to general improvement, by supposing that he was ignorant of the advantages and disadvantages of his own scheme, particularly as he has himself so frequently acknowledged the latter. Though he thought it right to arrange the subjects arbitrarily, and chiefly by their external characters, because, those but little informed could then co-operate with the more erudite, he must have known that he violated the arrangement of nature; for even with respect to plants, he separated the individuals of their families, and placed them apart amongst strangers with which they had no natural connection. Of his twelve Botanic Classes, there are but two which have a claim to be considered natural; and even in these, it is not unexceptionable. I allude to the classes Tetradynamia and Syngenesia. Surely, too, Linnæus must have perceived that he committed still greater outrages against natural order in the animal kingdom. I would never advise my young friends, to endeavour to raise their own reputation, by attempting to depress that of another; for general observation speedily detects what each has done for the promotion of science; and their respective merits are impartially appreciated by the public; therefore the attempt to undervalue another, becomes an offence against public opinion, and at the same time, "shows a most pitiful ambition in him that uses it."

Mr. Hunter knew nothing about systems; when he met with an animal he had never dissected, he cared but little by what name it was called, to what family it belonged, with what others it was associated, either by natural or artificial ties. He chiefly wished to know, how its food was digested: how its blood circulated; how it respired; what were its feelings, instincts, and habits; how it secured or defended itself from injury; how the multiplication of its species was effected and insured. Yet, by noting the facts relative to these subjects, it surely must be interesting to observe, how much his arrangement and exhibition of structures correspond to those lately displayed in systematic works; in which also will be found an arrangement of the animal kingdom, more suited to the purposes of Comparative Anatomy, than that of Linnæus.

In asserting the claims of Mr. Hunter, I should not omit to mention that he was a very candid man, and freely divulged whatever he knew or thought, as far as his powers of communication enabled him. His biographer says, " his disposition was candid and free from reserve, even to a fault; for it sometimes made him appear harsh." Doctor Hunter, in his Lectures, frequently mentioned his brother's opinions on different physiological subjects. Mr. Hunter himself began to give lectures in the year 1770. Since the year 1785 the preparations in the Museum have been arranged as they now are, and publicly exhibited. That Mr. Hunter's facts and opinions respecting physiology in general, have gradually become known to the nations on the continent, have been adopted and incorporated with their knowledge of that science, is to me very manifest. I mention only one instance in evidence of this proposition. In some late foreign systems of Physiology, the nerves are called organs of calorification; though without adequate reasons being assigned for so novel a denomination. That his facts and opinions, relative to the comparative structure and functions of animals, should have travelled in like manner, and met with a similar reception, does not seem improbable. Both Professors Camper and Blumenbach were in London, and were, as I believe, well acquainted with Mr. Hunter's labours. Such were the circumstances that promoted the diffusion of Mr. Hunter's discoveries and opinions. No one could be more fully aware of the uncertainty of knowledge than he was; and this occasioned his tardiness in publishing either his discoveries or opinions; which may have given a seeming priority to the works of others, and prevented the knowledge that flowed from him from being traced to its proper source by the public in general. On the contrary, however, I cannot but suspect, that the great illumination which Comparative Anatomy and Physiology have of late received on the continent, has in a considerable degree resulted from reflected light, originally emanating from materials which Mr. Hunter brought together, and from his brilliant physiological discoveries.

In advocating the cause of Mr. Hunter as a Comparative Anatomist and Physiologist, all I can do is to tell when I think he first ascertained certain facts, or drew certain conclusions. Yet I know it is difficult to prove these propositions, and as I have said,* I shall be often obliged to refer to

* Lecture I. page 7.

his writings, in 1776, to show the extent of his information and views at that time. If, however, I fail to prove his title to priority of discovery, or opinion; still I feel persuaded that what I shall say of him will not be deficient in interest, for I cannot suppose any one will believe, that the unlettered John Hunter borrowed his evidently original opinions; or that the works of his own hands were copied from those of others. If others preceded him, he will still appear like Ferguson the astronomer; who, whilst a shepherd's boy, drew accurate charts of the Heavens, knew the course of the planets, was acquainted with the nature and application of the mechanical powers, constructed various time-keepers, planned and executed sun-dials in different aspects for his neighbours; and when at length his fame attracted the notice of the surrounding gentry, and a subscription was raised to send him to Edinburgh, that such rare talents might not remain uncultivated; he was, as he said, surprised to learn that all he knew, and much more, had been already known. Both instances will serve to show the extent of knowledge which rarely-gifted individuals are capable of acquiring by their own observation, ingenuity, industry, and reflection.

In the first department of his Museum, Mr. Hunter displays the firm and rigid parts of vegetables and animals; the substances or joints which connect them; and the powers which move them; as if he had thought it proper to define what living beings were, before he proceeded to show how they were formed, and what processes were carried on in them. Mr. Hunter thought that there was a principle of life in vegetables as well as in animals, and noted the identity of the vital processes in both. He adverted also to the similarity of their morbid processes; to the thickening of the leaves in vegetables, from the irritation of insects; and the growth of excrescences from the same cause. How extremely beautiful is the nest formed by the increased, but not unhealthy actions of life, for the young of the Cynips Rosæ (Linn.)? He observed how exactly correspondent to the processes of animal life is the exfoliation of the dead leaf in the autumn. If the leaf and stem equally and simultaneously perish, if a branch suddenly wither, the leaves tenaciously adhere by cohesive attraction; the detachment of the dead from the living parts being apparently the consequence of vital actions in the latter. There is one experiment of Mr. Hunter's I may mention, because it displays the reflective character of his mind, and the persevering industry with which he prose-

cuted every subject that excited his attention. Having set beans in a tub filled with earth, which had perforated apertures in various directions, he contrived mechanism to keep it constantly revolving round an axis, tõ show that the ordinary operation of gravitation had no effect in producing the extremely varied course which the young plants took in order to arrive at the surface.

Specimens of some plants, parts of which undergo sudden motions, stand first among the preparations in the Museum. Respecting this subject Mr. Hunter observes in his MS. in 1776, "All plants are not endowed with evident motions, yet in some, such motions occur in parts of them, and apparently from the application of particular stimuli, as the rising and setting of the sun, &c. Some also are affected by touch, so as immediately to be put in motion by it. Of the nature of the organization subservient to these motions, we are ignorant. We know not whether they may arise from organs formed purposely to produce them, or from all the neighbouring parts being joined in consent to occasion this effect. It seems probable, however, that the power is analogous to the irritability of muscles."

Next are exhibited the nutritive fluids both of vegetables and animals, and also the fatty substance which makes so considerable a part of the body in the latter class, because all their different structures must be formed from these nutritive materials. The nutritive fluids, or blood of animals, and the sap of some vegetables spontaneously coagulate; but in other vegetables, the addition of acetate of lead is necessary to produce coagulation. The nutritive fluid, or blood of insects, and the lower kinds of animals, is shewn to be colourless, with the exception of that of some worms which have red blood; and that in reptiles and fish, the red colour which is so generally considered as characteristic of that fluid begins to be added. Though blood is so subtile a fluid as to be capable of permeating the minutest vessels of the body, yet that part which spontaneously coagulates, becomes very firm, tough, and insoluble; often also assuming a fibrous appearance. From the exact similarity of these fibres to those of which muscles are chiefly composed, which Mr. Hunter has taken great pains to exhibit in preparations you will observe in the Museum, he inferred the identity; an inference which modern chemistry has since established.

With respect to animals, Mr. Hunter observes in M.S. 1776, "In the more imperfect animals, it is very probable

that there are no fixed parts, but that all parts are irritable and have motion, like the urinary bladder or an intestine. As animals become complicated, and have various motions, especially the progressive, then such motions are more divided or partial; for which purpose it is necessary there should be substances whose firmness and structure, and mode of connection, should divide and determine the motions to particular parts. These structures are differently placed in different animals. In the earth-worm, caterpillar, and nereis, the firm structure is the skin, which is divided into rings, all of which have motion on each other, and into these are muscles inserted, so that a variety of particular motions is produced. In insects, spiders, and lobsters, whose firm parts are more complicated and answer a greater variety of purposes, we find the fixed parts still more dense. In the two former they are of a horny, and in the latter of a calcareous nature. These parts also make a covering for the animal, but there are processes of them going deep for the attachment of muscles. In tortoises, lizards, snakes, &c. though they have firm external coverings, yet there is an internal apparatus for motion, which is principally bone. In the more perfect animals, external firm parts are rarely found. They have an internal osseous skeleton, so that the muscles and their attachments are reversed; and thus we find them arranged in the fish, fowl, and quadruped." Mr. Hunter adds, "shell is a substance made use of in the animal kingdom, chiefly as a defence against accidents, serving the purpose of a retreat!"

This extract convinces me that there is scarcely any thing in Professor Cuvier's Lectures, relative to the construction of animals, with which Mr. Hunter was unacquainted; and it must be interesting to observe the correspondent views which these highly informed men have taken of the same subjects. As Mr. Hunter's object was Physiology, or an enquiry into the functions of Living Beings, he has not been solicitous to exhibit all the facts relating to their construction. Professor Cuvier, has, on the contrary, devoted his first seven Lectures to display the latter subject, in so ample and satisfactory a manner, as cannot, I think, fail to gratify the reader. Some animals are soft and undefended; some inhabit shells; some may be said to have an external articulated skeleton, serving also as a defence; and the rest an internal skeleton. He remarks, it is curious, that insects, having an external articulated skeleton, possess such a com-

bination of motive powers, that some of them walk, run, leap, swim, and fly with as much facility, as beasts, birds, and fish, exercise one or more of these faculties. Professor Cuvier thinks that they are indebted for these advantages, to the numerous articulations which their case or skeleton possesses. It might strike a person who had not considered the subject, that there were animals possessing both an internal and external skeleton, as those of the reptile tribe. The muscles of insects, however, act upon the external case, which is therefore similar to the skeleton. The shells of tortoises are to be considered merely as armour, as defences against injuries, which the animals have neither the power to oppose, nor agility to avoid. Even amongst the higher order of quadrupeds, some wear this kind of armour, as the rhinoceros; and many have such thick hides, as protect their possessors from trivial injuries; hides like the leathern doublet of Hudibras, which

"Though not ball, was cudgel proof."

In the construction of animals, we find nature proceeding upon an uniform plan, and by variation of the same means, contriving to produce beings extremely diversified in form and faculty. It has been observed that Comparative Anatomy furnishes abundant facts to the natural theologian, shewing that intelligence must have operated in the construction of living beings, by the evidence it affords of design, and of the adaptation of means to ends. This observation is however more perfectly verified by human, than by Comparative Anatomy; for so well is man acquainted with his own wants and desires, and with the structure of the human body, that he must be a dull, inconsiderate, or perverse character, who can contemplate the organs and structures which compose it, without a feeling of admiration. The very reverse however happens in Comparative Anatomy. Many of the animals we dissect, are, when living, concealed from our view; they are hid beneath the surface of the earth, or the waters; they fly aloft in the air; or secrete themselves in the recesses of the forest; so that we have little acquaintance with their habits, or peculiar wants and desires. We cannot therefore, so well perceive the reasons of those varieties of formation we discover, nor judge of their adaptation to the peculiar exigencies of the being that possesses them. In many instances also the organization is extremely obscure, and in some it is probable that it never can be developed.

There are minute animals, the motions of which are extremely vivacious, and in which all the processes of life are carried on with great celerity and vigour, yet no organization can be detected in them, even by the aid of the microscope. We are, therefore, obliged to conclude either, that there may be organization which is wholly undiscernible; or that life can execute its functions unconnected with those kinds of organization which we observe in animals in general. Whatever may be the structure of animals, we cannot however but perceive, that each possesses means of procuring sustenance adequate to its wants; so as to ensure its perfection of health and growth, and powers to continue its species, which seems to be the consummation of animal existence. Neither can we avoid remarking, how admirably the perceptions and faculties of animals are adapted to the situation which they occupy in the graduated scale of existence. As far also as we can discern, we perceive the same evidences of design and admirable contrivance; and the facts we learn from the examination of the structure and functions of living beings in general, may indeed be said, "to come more home to every man's business and bosom," than any we collect from the study of Nature in other departments of science.

You find displayed in the beginning of the Museum, many forms of the moving powers or muscles; and also the uses of elastic ligament are shewn, which sometimes produces motion, and sometimes retains parts in certain positions, by its mechanical properties, without the expense of muscular exertions. It is this substance which keeps open the valves of shells and the claws of lobsters, so that no power is exerted but in closing them; it is this substance also which supports the heads of animals, without muscular effort, whilst they are grazing.

I remind you, gentlemen, that Mr. Hunter, who did not consider life to be dependent on organization, was I believe the first who clearly ascertained and publicly announced the fact, that muscles, after contracting to their utmost, might gradually acquire a new sphere of contraction. This fact was first ascertained by the following case, which I relate, because I believe it is not generally known. A lady who had both kneepans broken and greatly retracted, came to London, many years after this accident, and consulted Mr. Hunter on her case. Almost every other surgeon would have considered it hopeless. He, however, who was constantly thinking about the reparative processes, began to en-

quire whether the long union which had taken place between the distant portions of the bone was of a ligamentous and unyielding nature. To ascertain this point, he endeavoured to force the upper portion still higher, and found that the lower followed it, and that a motion of the leg was thus produced. The muscles were however unable to move the retracted part of the patella, because they had already withdrawn it to the utmost extent of their original power. Mr. Hunter saw no reason why muscles, thus circumstanced, might not acquire a new sphere of contraction, yet he saw no mode by which they were likely to do so, except through the influence of the will of the patient; and to persuade persons to will what must appear to them an impossibility, was the chief difficulty he had to encounter in his endeavour to ascertain the proposed subject of enquiry. He persuaded his patient to sit on a table, and suffer her legs to swing backwards and forwards. This they did in the same manner and from the same causes that a pendulum does. She could indeed retract the limbs further under the table than their pendulous motion would carry them, by the agency of their flexor muscles, but she could neither check their motion in this direction, nor prolong it in the opposite one, by any exertion of the extensors. Mr. Hunter urged the patient to sit at intervals for an hour or more a day, wishing the exertion of such powers might take place; and she promised to comply with his request. After a time, she became persuaded she had in a degree acquired her object, and thus encouraged, her will became more energetic, and the muscles more obedient to its mandates; till it was evident to others that she could check the receding motion of her limbs, and prolong the advancing one. Mr. Hunter then attached weights to her feet, to increase the demand for muscular effort, and thus, by degrees, did the patient acquire the power of extending the legs on the thighs, and the consequent ability to stand and walk. That muscles may acquire a new sphere of contraction, was afterwards fully proved by other cases; and Mr. Hunter has put up in his collection of anatomical facts, illustrative of the vital functions, the biceps muscle of both arms of the same subject; the one, which is of its natural length, measures eleven inches; the other, which has become contracted in consequence of the arm being broken, and the bones overlapping, measures only five inches. Nevertheless, in this state, the bones having become firmly united, the shortened muscle acquired a new sphere of con-

traction. The particulars of this last case are recorded by Sir Everard Home, in a Cronian lecture, published in the Philosophical Transactions for 1795.

Mr. Hunter next displays the anatomical facts relating to the formation of bone, and exhibits specimens of that variety, the black periosteum of the silk fowl of Guinea. He also shews the various kinds of joints and substances by which the bones are connected. The formation of shell, and the growth of horns, are likewise exhibited by various preparations. As these subjects have been already considered in this theatre, I have no wish to say any thing about them on the present occasion, except in reference to one particular.

Every one at all acquainted with the mind of Mr. Hunter must be assured that he could not fail to be much interested with the facts relating to the annual renewal of the stag's horns. Those of other animals last for life, and yet the large and curiously-branched horns of the stag, though formed of equally durable materials, are cast off annually, and replaced with a celerity of growth that would scarcely be credited by any Physiologist who was not well acquainted with the fact. Of Mr. Hunter's observations on this subject I shall speak hereafter; at present I only wish to mention that he particularly noticed the fact at that time not commonly known or attended to, that, if a stag be castrated, the horns, which are shed annually, are not afterwards renewed; so that the animal having lost the male powers, no longer exhibits their external characters. We do not find, however, Mr. Hunter drawing any inference from this fact, for it warrants none other than the want of the beard in man, would do, from a similar cause, provided he also became baldfaced annually. On the contrary, however, we find him much excited by observing, that when the sexual character is annulled by age, the appropriate external signs are not only discontinued, but sometimes opposite ones exhibited. He really seems interested in observing, that old women sometimes become bearded, and that the old hen pheasant forms and displays the beautiful plumage of the male bird.

In some late works on Physiology, I find it suggested, that the formation of one part or organ, creates a necessity for the formation of another; and therefore it happens, I presume, according to this mode of reasoning, that men become bearded and stags wear horns. Yet these writers have not suggested any reason for the occasional exhibition of the delusive signs to which I have been referring, and I

suspect that the consideration of this subject in general, has been omitted, in drawing such conclusions as I have just referred to.

According to Mr. Hunter's notions of life, those occurrences which denote the sexual character are to be considered as the effects of sympathies existing between remote parts of the body; which, like other instances of sympathy, are liable to occasional failure and considerable variation. That such sympathetic actions are the effect of unknown laws, he could never have doubted; but he thought he perceived a spirit and design in these laws very different from those which produce results in dead matter. In the latter the results are immediate and uniform, so that they may be predicted; whilst in the former they sometimes do not take place, and appear more like the effects of option than necessity; they also are subject to considerable varieties; neither is their result in many instances immediate; yet the actions tend to produce some remote effect or good to the individual in which they occur. That such were Mr. Hunter's ideas of the vital actions may be inferred from his unphilosophical language, which imputes design to unintelligent agency.

Mr. Hunter seems first clearly to have perceived that we could not judge of the vital actions from other subjects, and therefore that the zoonomia must be made a separate study and pursuit by comparing the vital processes with one another in the same animal, and in all the varieties of living beings.*

Under the influence of these notions, we cannot be surprised that he is interested in recording the facts, which seemed to him to shew that when age has annulled the principal sexual powers, their appropriate external evidences are not only discontinued, but sometimes those of an opposite character are displayed.†

The difference of form and character between the male and female of most animals is in general considerable and striking, and denoted by circumstances very diversified, but

* If, indeed, all the phænomena of life were produced by the super-addition of a subtile substance, or substances capable of causing chemical composition, decomposition, variations of temperature, and actions, according to the suggestion contained in the first lecture, page 15, without being regulated by any other vital energy, but acting in conformity to pre-established laws; still the results are so different from what we observe from the operation of the same causes in matter in general, that the laws of life must be peculiar, and, therefore, require to be made a separate study.

† Mr. Hunter's paper on this subject will be found in the Philosophical Transactions for 1780.

not reducible to any general rules. Yet this difference does not seem a consequence of necessity, for there are some species of animals in which it scarcely can be said to exist, and in others the female is the larger and stronger, partaking m oe of what we usually deem the masculine character.

That the characteristic signs of either sex are in general deficient, in proportion to the deficiency of the most essential and important of the sexual organs, must be admitted. Yet as the cases denoting this fact in the female, are not common, it may be proper to refer to some of them. Mr. Pott removed the ovaries of a woman which had been protruded from their natural situation into the groins, like hernia in common. The uterus never afterwards menstruated, the breasts wasted, and the body became muscular and robust. Mr. Pears relates the case of a woman born without ovaries, in whom the other sexual organs were formed, though they remained in a dwarf and inefficient state. She never manifested any of the attributes of the feminine character. She was broad-shouldered, and small round the hips, like a man.*

How fond Mr. Hunter was of animals, how closely he observed their form, habits, modes of action, and progression, Sir E. Home has already told us in this theatre. He preserved the skeletons of most of the animals he had dissected, and there are probably 300 specimens in boxes, which he had no room to display, neither is there space enough in this building. That he was an observant and accurate ccomparative osteologist is also apparent from his last papers in the Philosophical Transactions, containing a commentary on fossil bones, found in caves near Bayreuth, and elsewhere. Mr. Hunter has, however, exhibitied and contrasted some of the skeletons of animals, and preserved specimens of those of rare and curious forms; he also collected the heads of persons of different nations. Yet still I am aware that the Hunterian Museum may by some be considered as deficient in the department of osteology, and, as has been before observed, the minute examination of the form of animals did not come within the scope of Mr. Hunter's designs.

Having derived much gratification from reading Professor Cuvier's remarks on this subject, and believing that there is much food for meditation even in a skeleton, I shall put together some observations on the form and mechanism of that of

* Philosophical Transactions for 1805

the human subject; for as anatomy is chiefly taught as the ground-work of medical and surgical knowledge, such observations are not in general incorporated with systematic treatises on that subject.

The head is formed into the bony cavity, which contains the brain, called the cranium; and the face which is the seat of four of the senses, that are situated near the organ of sensation, volition, and other faculties. In proportion to the size and complexity of the brain, with reference to the size of the nervous system, do animals appear to possess various kinds and degrees of perception and intelligence. Camper and Hunter, at the same time, attended to the apparently descending series in the construction of the heads of animals. The head of the African does really in some degree, and in some individuals more particularly, approximate in form to that of the monkey; in the sloping direction of the forehead, the size and depth of the temporal fossa, in the flatness of the nose, the projection of the teeth, and the diminution of the chin. We also observe this approximation in other parts of the African skeleton; in the length of the loins, and in that of the fore-arm and leg, compared to the arm and thigh; in the flatness of the foot, and projection of the heel. In the head of the monkey we distinguish the same things, but in so aggravated a degree, that we at once recognize the head of a brute, possessing little cranium and much face, a mere approximation of form to the human head, a mockery, with which, in general, we are more disgusted than pleased. In the quadruped, the forehead is nearly an horizontal continuation of the face, and the jaws, so greatly extended, that the cranium is but little apparent, and the face constitutes the chief part of the head. In the bird and in the fish we observe the same circumstances, but in a much more striking degree. So greatly did these observations interest Sir Joshua Reynolds, that, in his portrait of Mr. Hunter, he has left his portfolio open at that part where this descending series is sketched.

This is the first time, on the present occasion, that I have to call your attention to the very curious and problematical concatenation which exists in all the works of Nature. In the African, we perceive a link connecting the human form with the extremely diversified forms of the brute creation. I cannot forbear to add, that though there is an approximation in the form of the African to that of brutes, there is none in his nature; for well educated Africans have displayed great powers of mind.

Camper also remarked, that the heads of persons of intellect, were generally characterized by a large and prominent forehead; and that in the Greek antique head, the forehead is made to project beyond what is natural, or has been ever observed. It has, I believe, been a question among artists, why we are so fascinated by the sculpture of the Greeks. The intellect of the Greeks seems superior to that of most other nations; their philosophers, poets, orators, and designers, have all left us models difficult to imitate, almost impossible to surpass. With a kind of intuitive perception of the το καλον, of whatever is excellent or beautiful, they formed an ideal perfect head, and have exaggerated those circumstances in which the human head differs from that of a brute; yet with a delicacy that leaves the excess beyond what is natural to man, not readily distinguishable. The head of a brute has its forehead oblique, or declining towards a horizontal line, drawn from the top of the face; and the sides of the forehead converge from the orbits, so as to make it narrower at the top than at the bottom. The Greeks made the human forehead advance a little before a perpendicular line, and they raised it to an uncommon height. They made it also diverge from the orbits, so as to be broader above than below. The eyes of animals are placed at the sides of the head, so that they see laterally, and some even behind them. The human eyes are made to look forwards; whenever they glance to a side, they indicate either fear or distrust. The Greeks seem to have paid attention to this point; the eyes are made to look strait forwards, and the outer edge of the orbit is so wrought up, as seemingly to preclude a contrary vision. The eyebrow is a feature peculiar to the human face; and I think it must be regarded chiefly as an organ of expression. In the antique head, this part is finished with much labour and skill. The bridge of the nose is also peculiar to the human face; it is represented very prominent, or raised much above the level of the orbits. The Greeks thought it most beautiful when it proceeded in a strait line from the forehead, whilst the Romans preferred it arched. The nostrils are formed as little like a snout as possible; they are apertures for respiration, and for smelling, in the human subject, and their motions contribute to expression. The orifice of the mouth, though occasionally used for eating, seems chiefly constructed in the human face, for the articulation of our words; and the motions of the lips are also strongly indicative of our feelings. The Greeks represented

the mouth according to these views of the subject. They made it as little like a devouring aperture as possible. They made the orifice of small dimensions; the lips thin, but muscular and expressive; and they sometimes even flattened the arch of the jaws in an excessive degree. The chin, which is peculiar to the human countenance, they made to project very considerably, and in the males they represented it broad. I forbear to say more, because this is a subject rather of taste than of science; yet design all this, effect but this, and you will form the front of Jove himself.

Doctors Gall and Spurzheim tell us that brutes have a forehead and hind-head, but they want the middle part of the head, which is peculiar to man. Man is a long-headed animal; there is a great extent of brain between the fore and hind parts. The top of his head is arched, and in some individuals, in a peculiar degree, so that the hair falls to either side, and hence results the naturally parted forelock; and it is there that our new cranioscopists believe they can discover signs indicative of moral sentiments and excellence. Perhaps some spice of vanity may be perceived in Milton's description of the head of Adam, for it seems to be copied from his own.

> His fair large front and eye sublime declar'd
> Absolute rule; and hyacinthine locks
> Down from his parted forelock manly hung,
> Clustering;

Doctors Gall and Spurzheim further tell us, that the instincts or propensities of brutes may be judged of from the form of their heads, and assert the same with regard to the human subject; which latter assertion does not appear discordant to general observation. For if the human head be more produced in those parts peculiar to man, so does its possessor frequently appear to have more of the intellectual character; or if in those parts common to him and brutes, so has he more of the propensities in which he participates with animals in general. Even this was observed by the Greeks, who, to use Dr. Spurzheim's own expression, "never committed such an absurdity as to put the head of a gladiator on the shoulders of a philosopher, or the reverse."

The speculations of these gentlemen appear to me very ingenious, and calculated to unravel some of the intricacies of the human character, as well as to establish a just distinction

between the faculties of animals and those of man. The peculiar original dispositions and talents which certain individuals possess, must either be ascribed to original qualities of mind or to causes which may produce them. To me, who think it absurd to suppose that perception and volition are the result of organization, or an affection of mere life, and consequently who believe them to be properties of something distinct, it is even pleasing to perceive how any thing essentially perceptive and possessing consciousness and volition as the natural and seemingly necessary adjuncts of perception may be variously affected, and consequently prone to certain actions. To me, the plurality of our senses has always appeared a strong argument for the individuality of mind. I see, I hear, I am variously affected. I am more delighted with the objects I behold, or more charmed with the melody I hear.

If Doctors Gall and Spurzheim tell us, that in consequence of certain conformations of our brains, we have propensities, such as brutes also possess, productive of good or evil according to the degree or direction in which they are exerted, they only attempt to account for facts of which we are all conscious. Men are by nature brave or fearful, generous or covetous, candid or cunning, fickle or determined; and these original qualities, though they admit of being controlled and suppressed, cannot be altogether annulled. Our great student of human nature and conduct, whose representations of them must ever render him the delight, admiration, and glory of his country, has also metaphorically pourtrayed that mixture of good and evil which belongs to the human character. "Our web of *brain* is as a mingled yarn, the good and ill together; our virtues might be proud, if our vices whipp'd them not; and our vices would despair, were they not cherished by our virtues."

There is nothing in the assertions of Drs. Gall and Spurzheim contradictory to the results of general observation and experience. It is admitted that the superior intellectual faculties can and ought to control the inferior propensities. It is admitted that we may possess organs, which, nevertheless, may be inactive, from natural torpor or want of education. General observation and experience proclaim, that susceptibility is the chief incentive to action, that it is the source of genius; and that the character of man greatly depends upon his education and habits. We educate our faculties; what is at first accomplished with difficulty, by repetition is easily

performed, and becomes more perfect and established by habit. Trains of perceptions and thoughts also become firmly concatenated, and occur in succession. Even our feelings undergo the same kind of education and establishment. Casual feelings of good-will, by repetition, strengthen and produce lasting friendship; whilst trivial sensations of disgust, in like manner, may occasion inveterate hatred. When the remembrance of our perceptions recurs, they are often concatenated with other perceptions, modified by reflections, and associated with feelings; and it is by means of the repetition of such trains of perceptions, thoughts, and feelings, that habits of thinking and acting are acquired and established. Yet such reflections and associations are produced and regulated by the actions of our own minds; and it is therefore evident, of whatever materials Nature may have made us, she has at least given us great powers of forming and fashioning ourselves. Had the dispositions and powers of our minds been similar, human life would have been dull and monotonous. Their variety enables us by education to attain different kinds and degrees of excellence, and to be useful to one another.

The very supposition of the organs which are said to form the distinctive characters of the human race, appears to me extremely ingenious. Every one knows that some individuals are more prone to the accurate notation of facts; others to their comparison, and to forming judgments from analogy; others to the investigation of causes; and others to those sportive combinations of similar and dissimilar things productive of wit and humour; which facts are attributed to the organization of the brain being more active or developed in different parts. I need not tell you, gentlemen, that I went to school a long while ago, and that what I was there taught has become established by repetition and habit, so that I cannot readily express my meaning, without the use of the old terms, cause and effect; it seems proper, therefore, to explain what I wish to express by them.

In several medical books published of late, I read, that we have no knowledge of cause or effect, save what results from the continued observation of the priority of the one, and the consequence of the other. I was however taught to believe that we had by enquiry attained a rational assurance of the nature of cause and effect in a great number of instances, and might, by a continuance of the same endeavour, probably obtain it in others. All our knowledge is derived from

our perceptions, and they inform us, that if one body in motion impinges on another free to move, the latter receives part of the motion of the former according to the degree and direction in which the force has been applied. If, therefore, I push a bullet contained in a tube, in a horizontal direction, I infer that it moves for the same reason, or from the same kind of cause. But if I put the tube in an oblique or perpendicular direction, I find the bullet move with different degrees of velocity and force from another cause, gravitation. If I explode gunpowder in the lower part of a tube held in a perpendicular direction, containing also a bullet, I find the ball forced upwards for a time by one cause, and then it descends in consequence of another. My senses may indeed inform me of the appearances of light and shade, in the surfaces of spherical and many-sided figures; but if, after having studied all that human ingenuity and industry has discovered relative to these subjects, I am able, in the absence of the object, to represent upon paper a spherical or many-sided figure, do I not manifest a knowledge of the causes of light and shade beyond that which my perceptions alone would have produced? If also, I can at will present the angle of a prism to a luminous body, so as to produce the regular exhibition of the rainbow colours, do I not exhibit a knowledge of the causes of such effects? If indeed the retailers of such sentences as I have been commenting on, merely design to inform us that we have no knowledge of the precise means by which a cause produces an effect, they surely need not have exhibited so much parade in shewing what is constantly seen and acknowledged. If however they mean to insinuate, that we have no knowledge of cause or effect beyond that which results from mere observation, they publish at the same time, a libel on the human understanding; a prohibition to rational enquiry, and a most severe satire on themselves.

Should the result of our general enquiries, or attention to the subjects proposed to us by Drs. Gall and Spurzheim, eventually induce us to believe that the peculiarities of our feelings and faculties were the effects of variety of excitement transmitted through a diversity of organization, they would tend to produce mutual forbearance and toleration. We should perceive how nearly impossible it must be that persons should think and feel exactly alike upon any subject. We should not arrogantly pride ourselves on our own virtues and knowledge, nor condemn the errors and weakness of

others; since they may depend upon causes which we can neither produce nor readily counteract. The path of virtue is plain and direct, and its object distinctly before us; so that no one can miss either, who has resolution enough never to lose sight of them by adverting to the advantages and allurements, with which he may be presented on the one hand, or the menacings with which he may be assailed on the other. Yet no one, judging from his own feelings and powers, can be aware of the kind and degree of temptation or terror, or the seeming incapacity to resist them, which may have induced others to deviate. Now, though, from the foregoing considerations, I am pleased with the speculations of Drs. Gall and Spurzheim, I am however quite incompetent to give any opinion as to the probability of what they have suggested; because I see no mode by which we can with propriety admit or reject their assertions, except by pursuing the same course of investigation that they themselves have followed; a task of great labour and difficulty, and one which, for various reasons, I should feel great repugnance to undertake.

After these general observations on the form of the human head, the mansion of the mind, and the index of its character, I proceed to describe that of the teeth, which commonly make a part of the skeleton. In man, they must be regarded chiefly as the means by which he masticates his food; yet Mr. Hunter did not, in my opinion, consider the teeth of animals in general as subservient principally to this purpose, but placed them in his Museum, for reasons that will hereafter be explained, among the instruments and weapons that are allotted to animals.

The four front teeth, in man, have their edges overlapping each other, like the blades of a pair of scissars, and seem well calculated to cut in slices the food which admits of such a division. The side front teeth, which correspond to those teeth in animals, called tusks and tushes, fangs and venom teeth, are in the human subject, round in front, flattish behind; they increase in size as they project from the gum, till having attained their greatest magnitude, they become suddenly and obtusely pointed. They have long roots inserted deeply in the jaws, and the pointed termination of their bodies projects a little beyond the level of the line made by the edges of the other teeth. These teeth seem well calculated for breaking into small pieces hard substances, and thus preparing them for the action of the grinders. All the

back teeth in the human subject are grinders, and there are two small and three large on either side, in each of the jaws.

That nature meant man to grind his food by means of his teeth, is to be inferred, not only from their form, but from the mechanism of the joints of his jaws, from the great strength and various actions of his muscles of mastication, and from the lever formed by the coronoid process to increase their power. I do not know, however, that we are warranted to infer from the teeth alone what kind of food nature designed us to live on. Some vegetables and animals are peculiar to certain districts, and will not thrive in other situations; whilst other kinds of vegetables and animals, are found more generally distributed over the surface of the globe. Grass and corn thrive every where. Man also seems an universal animal. He can and does live in some places upon vegetables only, whilst in a Greenland winter, his chief sustenance is derived from oil and fish. Nature may have given man means to grind his food, that he may extract the greatest quantity of nourishment from a deficient supply of it; and he can by mixing different kinds of food qualify substances for trituration, which by themselves would be unsuited to that process. It is also one of his characteristics, and in which he seems much to delight, that he is a cooking animal. The human teeth are also of great use in the articulation of our words.

I should certainly not fulfill one of my objects in these Lectures, which is to display, to the extent of my ability, the merits of Mr. Hunter, were I to omit in some part of them, to notice the surprising labours he bestowed, in investigating the structure and functions of animals of the whale kind. In all the works of nature, we perceive extreme variety. The teeth are not only various in their formation and re-production, but also in the substances of which they are formed, and the purposes which they serve: and as some of the whales present a very curious instance of this sort, I trust I shall be excused, if I introduce the subject on the present occasion. In Mr. Hunter's paper relative to the structure and functions of animals of the whale kind, there is abundant evidence of the peculiar character of his mind. We see the student of nature on the most extended scale, solicitously enquiring into all those particulars which adapt these animals to the peculiar situation they occupy in the scale of existence. The horizontal direction of the tail, so different from that of fish, and the cause of the peculiar strength of

the flexor muscles, analogous, as he says, to the lumbar muscles of animals, is shewn to be calculated to raise the most prominent part of the animal, where the blow-hole is placed, above the surface of the water for respiration; whilst the horizontal motions of the tail are equally adapted to depress it to the depths of the ocean in search of food. The motions of the tail cause these animals to move up and down in a curvilinear direction, which makes them appear hump-backed, and thus the dolphin is generally represented. We see this in porpoises when they swim slowly and near shore, alternately respiring and grubbing along the bottom. Yet these creatures can, with their powerful tails, scull themselves forwards in a strait direction with surprising speed, passing a ship whilst she is going at the rate of ten miles an hour, with the same apparent celerity, as if she were lying at anchor.

The back bone of this tribe of animals, is formed as in quadrupeds*; it has not the flexibility nor lateral motion of that part in fishes, neither have they side oars or fins, and therefore they are unable to pursue the quickly varied and versatile motions of the finny tribe. They say, however, that a squadron of porpoises will encompass a shoal of herrings and drive them into a small bay to devour them. Though many of the whale tribe have teeth, they probably chiefly feed upon medusæ, sepiæ, shrimps, &c. which they find on the shores and depths of the ocean, or when pressed by hunger, they may destroy and devour one another. Mr. Hunter found the eye of some kind of whale undigested in the stomach of the grampus. We cannot consider them as predacious animals, for these in general, are suspicious, cunning, and solitary, whilst the whale tribe have an opposite character. The porpoises accompany our ships on the voyage, and they say the dolphin has been known to come to the shore when called for food he had been accustomed to receive; observations and stories of this kind may have formed the basis of different poetical fictions.

For so monstrous a creature as the great whale, when thus constructed to obtain a supply of food for its vast bulk, would appear to us, were we ignorant of the means which nature has contrived, a subject of the greatest difficulty. But she has made his mouth an enormous trap, and has given him whalebone teeth, the fringed edges of which form a finely

* Mr. Hunter has put up a preparation of the intervertebral substance, which is similar to that of quadrupeds in general.

meshed net to encompass his prey. We must suppose him groping along the bottom of the ocean, his jaws extended, his mouth a vast chamber, twenty or thirty feet in length, and ten or twelve in breadth, filled with water, containing medusæ, sepiæ, shrimps and small fish, when gently closing his jaws, they are encompassed in a net formed by the decussating fibres of the fringed edges of the whalebone teeth. The tongue, which is soft like a feather bed, and very thick, being applied to the roof of the mouth, the water is expressed through the apertures of the net, and then the food is swallowed. Thus is the most powerful Leviathan obliged to obtain his livelihood by the exercise of the wily arts of the fisherman.

Mr. Hunter supposes, that the oil and spermaceti which these animals form in such abundance, not only serves to give them buoyancy, but also proves a storehouse of nutriment in cases of failure in the ordinary supply of food; for he found the cells that contain spermaceti empty in some instances, which he thought, indicated that the animal had been for a long time without food. The whole of the whale tribe have also complicated stomachs like those of ruminants, which enable them to extract the greatest quantity of nourishment from whatever food they may obtain. I must not pursue this subject further, but merely recommend those who wish to do justice to Mr. Hunter, and form a fair estimate of his labours and merits, to peruse this paper with consideration.*

* Philos. Trans. 1787.

LECTURE III.

THE head is placed on the top of a column of bones, which, from their having in general a kind of turning motion on one another, are called vertebræ, and the whole pile is called the vertebral column. The base of the column rests upon a wedge-shaped bone, interposed between the side-bones of the pelvis. Each vertebra has belonging to it, a part called its body, which is of an oval or circular form, and presents two plain surfaces to the bone above and below, which are cemented together by the intervertebral substance.

The bodies of the veterbræ appear in front of the pillar, laid one upon another, like the stones with which a column is erected. They chiefly support the weight of the head and trunk, and regularly and considerably increase in size, as they descend, because the weight is proportionately augmenting.

The intervertebral connecting substance is composed of concentric layers of tough, strong, and unyielding ligaments, which extend for about a quarter of an inch from the circumference of the body towards its centre, when the connecting substance appears softer, and is manifestly elastic; which appearance continues till it approaches the centre, when the still connecting matter becomes pulpy and inelastic. The exterior concentric layers of strong unyielding ligament serve for security. The quantity of elastic substance interposed between the several vertebræ, is not so great as to occasion any insecurity in their connexion, yet the aggregate elasticity of the whole, renders the vertebral column very springy; so that the head rides upon its summit, undisturbed by jars, and as upon a pliant spring. The central inelastic matter admitting of a ready variation of form, though not of bulk, serves as a pivot facilitating the motion of the vertebræ on one another. Doctor Maclaurin in his lectures delivered more than half a century ago, was accustomed to illustrate its use by comparing it to a bladder partly filled with water, and placed between two trenchers; in which case, the water would readily diminish in bulk as the circumference of the trenchers became approximated on the one side, and would occupy the increasing space on the other. As the exterior ligaments are unyielding, this variation of form in the central pivot could never have taken place, had not an elastic substance intervened between them.

It is interesting and creditable to human intellect, which thus penetrates into the designs of nature, to know, that in the great fish, the squalus maximus, or basking shark of Pennant, this, then merely suppositious, structure is actually found. There is in the centre of the intervertebral connection a bag of water, and so great is the elasticity of the substance by which it is surrounded, that when Mr. Clift cut into the bag, the expansion of the elastic matter, projected the fluid to the height of four feet in a large and perpendicular stream, compressing the bag into a small compass, and forcing its sides into numerous wrinkles.

Behind the body of each vertebra there is a bony ring, and these rings, when opposed to one another, constitute a canal for the protection and transmission of that important part, the medulla spinalis. From these rings, seven processes are continued, four of which serve to make joints, connecting the vertebræ with one another. There are two ascending and two descending articular processes. Two processes also stand out laterally, and are called transverse, and one backwards, which, being in general pointed, is named spinous. These latter processes chiefly serve to give attachment to the muscles which support and move the vertebral column.

Upon the form of the articular processes, the degree and kind of motion which takes place between the several vertebræ, seem entirely to depend. In the neck, the opposing surfaces of the articular processes are smooth and oblique planes, a form which admits of a limited and equal degree of sliding motion forwards and backwards, from side to side, and also of a turning or vertebral motion of one bone on another. We know that the vertebral column in the neck, admits of an equal motion in these different directions, so that we can touch the breast with our chins, the back with our hind head, and the shoulders with either ear. We can also turn the neck, so as to describe with our face a complete semicircle. In the last motion, the effect is, however, augmented by the peculiar turning of the first vertebra upon the second, which will be separately described hereafter. In the neck we find the spinous processes short and horizontal, so as to afford no obstacle to the extension of that part, and we find them formed in a similar manner, in all animals which have long necks and carry their heads far backwards.

In the back, we find the articular processes formed into perpendicular planes, which preclude any motion either forwards or backwards, or any turning of one vertebra upon another; a form which allows only of a motion from side to side, to which, however, the ribs present an insurmountable obstacle. In the back, we find the spinous processes sloping considerably downwards, and absolutely locked together, by a sharp ridge of one being received into a groove of the other. We find, also, the rib connected to the transverse processes, so that every circumstance concurs to prevent any motion, save that which results from the elasticity of the intervertebral substance. It seems, therefore, evidently the intention of nature, to make the vertebral column, in the back, a fixed support for the ribs to move upon.

In the loins, we find the articular processes very differently formed from what they are either in the neck or back. The descending ones are shaped like half an oval, the convex surface of which is received into a cavity of corresponding figure in those which ascend, which form is admirably adapted to admit of the suddenly turning horizontal motion which takes place in this part of the vertebral column. It also freely admits of motion from side to side, but does not allow of it in any considerable degree either forwards or backwards. Indeed had such motions been permitted beyond a certain extent, the abdominal viscera would have been injuriously compressed by the ribs. Neither is much motion, in this direction, requisite, because we can carry forwards and backwards the trunk of the body, by moving the pelvis upon the rounded heads of the thigh bones. The spinous processes of the loins extend horizontally, so as not to interfere with one another in the turning motion, but their great breadth is prohibitory of extension beyond a limited degree.

The head is joined on to the first vertebra, (which. from supporting this globe on its shoulders, is generally called the atlas,) by two oval processes placed obliquely and received into corresponding cavities in the upper articular processes of this vertebra. The form of the bones precludes any horizontal or turning motion of the head upon the atlas, and admits only of a slight yielding forwards and backwards. The condyles are placed so exactly parallel to the centre of gravity, that when we sit upright. and go to sleep in that posture, the weight of the head has a tendency to preponderate equally in every direction, upon the slightest inclination in the line of gravity; as we see in those who are dozing in a carriage. Nay, their heads sometimes revolve in a circle, like the head of Harlequin on the stage. The head and atlas turn round upon the second vertebra; the upper articular processes of which, as well as the lower ones of the atlas, are formed into nearly horizontal planes, a form well calculated to admit of this motion. They are not, indeed. perfectly horizontal, but shelve a little to either side, so as to admit of a part of the lateral motion formerly mentioned. The second vertebra has growing up from its body a tooth-shaped process, and it is, therefore, usually called the vertebra dentata. This process is tied to the head by ligaments of surprizing strength, which are loose enough to allow the intended motion, but no more. This ready horizontal movement is requisite, to enable us suddenly to turn our eyes to different objects. If the head

turned on the top of the pillar, there would be insecurity, unless some especial contrivance, not essential to the head or vertebral column, was instituted, as may be inferred from facts observable in Comparative Anatomy. The head is attached to the very summit of the column in the centre, by extremely strong ligaments, whilst in the circumference it is secured, not merely by other ligaments, but also by those powerful muscles which constantly support it, and occasionally move it in various directions.

The spinous processes of the vertebræ are connected to one another by what is called an elastic ligament, with the obvious properties of which, every one is familiarly acquainted, from having encountered it at their meals, in the necks of animals, where it forms the ligamentum nuchæ, which supports the head of the animal whilst grazing, without the expense of muscular exertion. It is yellow, tough, firm, and powerfully elastic.

The spinous processes are situated so far behind the centre of motion, that if they had been tied together by unyielding ligaments, these must have been formed of considerable length, to allow of the greatest degree of bending of the column, and then they would have been useless and wrinkled in its common position. The elastic ligament admits of the utmost motion of the column, and, by its powerful elasticity, tends to restore it, and retain it in its natural form. The elasticity of the substance, interposed between the bodies of the vertebræ, also co-operates in restoring the column to its natural figure. If we take the vertebral column of a young subject separately from the other parts of the skeleton, and forcibly bend it in different directions, we find it suddenly and forcibly recoil, and assume its proper shape. The vertebral column is not straight; it comes forwards in the neck and loins, so as to appear like the top and bottom of a perpendicular pillar, but in the back it projects posteriorly, and describes a segment of a large circle. In consequence of this form, the back part of the chest, the blade bones of the shoulder, and the weighty muscles of the back, project behind the centre of gravity, and become equiponderant to the weight in front; and we know, that in an upright posture, the whole weight of the upper part of the body is so perfectly balanced on the base of the vertebral column, as to have an equal propensity to preponderate in every direction.

Though the motion taking place between the individual vertebræ is small, and such as can produce no alteration in

the form of the vertebral canal, injurious to the medulla spinalis, yet the effect of the conjoined motion of all the vertebræ is considerable; and appears still greater when observed in the motions of the head, which it supports. We can incline the head far forwards, backwards, or to either side, and nearly in an equal degree.

Had the vertebral column been formed straight, and the same extent of motion given to the head, the weight would have so preponderated, that its support would not only have been difficult, but it might have operated injuriously to the fabric of the column itself. As the column is constructed, when either end of it is projected in one direction, the other can be carried in the opposite, and the balance preserved. Thus, when the loins are brought forward, the neck and head can be carried backward, so as to preserve the line of gravity perpendicular to the basis of support; and *vice versa* in all directions.

By constant practice, the muscles are so habituated to produce these opposite and balancing motions, as involuntarily to do so with the greatest exactness, as well as to co-operate with the elasticity of the column, in restoring it to its proper direction and form. The requisite actions are slight, transient, and varied, and therefore produce no fatigue. This circumstance, together with the disposition of the column to maintain its usual form, and the ease attendant on these motions, cannot be better exemplified than in the instance of riding on horseback. A practised and fearless rider will fold his saddle cloth into a cushion, place it on the back of a rough trotting horse, and sitting on it, keep his seat, undisturbed by suffering all the succussions of the steed to be transmitted to the body, above the pelvis, and preserving that part fixed, by constantly keeping the line of gravity of the whole perpendicular to the basis of support. Thus do we enjoy the most springy ease of motion, and perfect fixity of position, with scarcely any muscular exertion, and without any effort of mind, for volition cannot regulate the action of muscles in this manner, and those who, from apprehension, seek security in their own efforts, lose it, in proportion as they strive to obtain it.

The vertebral column in the back affords support to the twelve ribs, one end of which lies imbedded in cavities formed between their bodies, and their tubercles are connected to the transverse processes. The ribs successively and considerably increase in length, as far as the seventh,

which causes the cavity they encompass to become larger; they then diminish in length, and the cavity of the chest becomes smaller. The seven upper ribs are connected by gristles to the breast bone. The five lower have their gristles united with each other, or have no connection except with the vertebral column. The breast bone is placed very obliquely, so that at the top it is very near the vertebral column, whilst at the bottom it is very distant. The ribs, in proceeding from the dorsal vertebræ, first take a direction backwards, and then rather suddenly turn forwards, so that the vertebral column projects into the cavity of the chest. This circumstance, and the oblique position of the sternum, both contribute to render the weight, before and behind the vertebral column, equiponderant upon its basis, in the manner I have formerly mentioned.

The upper or pectoral extremity of man, is divided into the shoulder, which is composed of two bones; the arm of one; the fore-arm of two; and the hand of many. The blade-bone of the shoulder is placed behind the chest, and not, as in brutes, by the side. It is in common so situated that the cup to which the arm is joined, and from which it hangs, projects exactly in the lateral direction, and consequently the weight of the arm has no tendency to move its socket forwards or backwards, but merely to depress it. Though the bones of the shoulder can be moved forwards and backwards, upwards and downwards, even in a considerable degree; yet the joint of the shoulder can never approach to the breast bone as it does in quadrupeds. The effects resulting from these circumstances are, that when the arms hang in their natural direction, the general line of gravity of the upper part of the body undergoes no change; but if the hands be brought either forwards or backwards, the weight proportionately preponderates, and the whole body moves upon the base of the vertebral column. The extent of motion of the shoulder joint in the directions that have been mentioned, greatly augments the sphere of motion of the arm and hand.

The joint of the shoulder is kept from approaching the front of the chest by the collar bone, which is nearly strait, though projecting a little forwards towards its middle, so as to give a slight convexity of outline to the top of the chest and bottom of the neck. The end of the collar bone, which rests upon the sternum, is bulky and of a somewhat triangular form, but it rests in a thick bed of cartilage, which pre-

vents its shape from being apparent. The scapular end of the collar bone is flat, and connected in a horizontal direction with a like-shaped projection of the blade bone, which forms the end of the shoulder.

When the trunk is bowed forwards, the hands swing in the same direction, and then the weight of the arm drags forward the shoulder joints. In weakly children whose bones are deficient in firmness, the collar bones yielding under these circumstances, become convex in front, and the bulky sternal extremities are in some degree dislodged from their cartilaginous beds. The blade bone is also drawn forwards on the convex ribs, so that the back part projects beneath the skin. The weight of the shoulders and head now bears, in some degree, upon the walls of the chest, being transmitted by them to the vertebral column, by which means they also become deformed.

So commonly do these causes operate in the manner I have mentioned, that we rarely see exactly such a collar bone as I have endeavoured to describe; they must have been very healthy when young, who have such collar bones as are represented in the Grecian statues. To prevent the deformities incident to the causes I have mentioned, parents are accustomed to brace their children's shoulders backwards; nor do I think the practice wrong, where it is required, and when it is conducted with moderation; but surely we ought to caution the public against the absurdity of bracing the shoulders back, beyond what is natural, till the blade bones come in contact with the vertebral column, for this destroys the natural balance of the body, and is more likely to produce than to prevent deformity.

The joint by which the arm is connected with the shoulder, is a ball and socket joint, admitting of motion in every direction. Even those animals, whose pectoral extremities seldom move in any other direction but forwards and backwards for the purposes of progression, have a similarly constructed joint. The advantage derived from this mechanism seems to be, that it admits of the motion of the limb, or of the body singly. Thus, when at rest, the limbs may be moved without disturbing the position of the body, and when the limbs are injured, slight variations in the posture of the body are permitted, without communicating motion to the limb.

The elbow joint moves like a hinge, backwards and forwards. Now, if the first joint be a ball and socket, and the second a hinge, it is manifest that the hand may be put in

almost every possible position within the area of that space, the circumference of which it is competent to describe by its utmost extent of motion. There are, however, two bones in the fore-arm; and one of them alone has its motions restricted to those of a hinge. This is called the ulna, and is the bone which sends backwards a projection, we name the elbow. The top of the elbow gives a surface for the attachment of the tendinous fibres of the extensor muscle, and affords a lever to increase its power. The lever in the human subject, is, however, inconsiderable, compared with what we observe in animals, the power of whose progressive motions greatly depends on the drawing backward of this part. We observe this in our dogs, and horses, and other animals; and it forms the first apparent joint in their pectoral extremities; for the arm and shoulder blade lie hid in the bulk and circumference of the body. The back part of the elbow in man, is formed into a smooth and somewhat triangular plain surface, upon which we occasionally lean. That nature designed this for an occasional resting place, is to be inferred from the coarse texture of the skin which covers it, which is similar to that placed over the lower part of the kneepan.

The form of the corresponding articular surfaces of the bone of the arm and ulna, freely admits an extensive motion forwards and backwards, and absolutely prevents any other. The bone of the arm has a groove formed in it, with lateral risings, and the ulna has a middle projection with lateral depressions. This groove making a kind of hinge for the ulna to move on, is formed obliquely, its upper part inclining towards the body. When, therefore, we bend the elbow, the fore-arm does not come in opposition to the arm, but carries the hand to the trunk of the body. When we bend the elbow, we generally wish to approximate or apply the hand to some part of our persons; and in consequence of the oblique direction of the pulley, we accomplish by one motion, what would have required two, had the groove been formed straight, as it is in animals. That part of the ulna which is next the radius, for so the other bone of the fore-arm is called, is hollowed out into a semicircular cavity, in which the radius revolves to a certain degree. The top of the radius is formed into a shallow cup, which fits on to a convexity of much greater extent of surface in the bone of the arm. Therefore, the cup can move forwards and backwards, in correspondence with the motions of the ulna, and can also, in any state of flexion or extension of the joint, turn round

upon its own axis. The radius has also a semicircular convex surface, which is lodged in the excavation of the ulna, and at the same time revolves in that cavity to a certain degree. Such is the mechanism by which we are enabled in any state of flexion and extension of the elbow, to turn the hand prone or supine, for whilst the radius is revolving upon its axis above, it travels round the ulna below, and carries with it the hand.

The surface, which the fore-arm presents to make the joint of the wrist, is an oblong cavity of little depth. It is formed chiefly in the radius, and partly in a piece of cartilage, continued from the end of that bone over the extremity of the ulna. The side surface of the radius, which is applied to the ulna, is hollowed out into a semicircular cavity, receiving a corresponding convex surface of the ulna; so that the hand and the cartilage, continued from the radius, moves round upon the end of the ulna.

The wrist is composed of eight little bones placed in two rows. They form an arch slightly convex on the back of the hand. There are projections in front on either side, forming its basis or spring. These are secured together by the carpal ligament which is of prodigious strength. There is a motion between the two rows of carpal bones, so that when the wrist is bent, the arch of the carpus forms a kind of knuckle without any angular projection. We find the same structure in the second apparent joint of the fore-legs of quadrupeds. What seems a knee is the wrist, and they kneel upon the knuckle of the carpus. The fabric of this part is particularly strong. Its arched form secures it from injury from above, the carpal ligament from below; but it is equally uninjured by forces applied to its side, else how could boxers strike with such force, or animals leap as they are known to do.

The four metacarpal bones, which are interposed between the carpus and fingers, are made large at either end, to form joints, and small in the middle, to afford room and arrangement to muscles, which move the fingers from side to side. Their bulky ends, which join on to the carpus, are connected by nearly plain surfaces, and admit of no manifest motion. The other ends, which support the fingers, are formed into rounded heads, and the first bones of the fingers have cup-shaped corresponding cavities, so that considering the skeleton merely, we might suppose the joint was one of the ball and socket kind, admitting of motion in all directions.

We find, however, that the ligaments are so arranged as to limit the motions of the joints chiefly to those of flexion and extension, allowing indeed of slight motion from side to side, and a slight horizontal turning of the finger on the end of the metacarpal bone, which motions are greatest in the fore and little fingers. The articular surface of this convex end of the metacarpal bones continues so far backwards and forwards, that we can extend the fingers a little beyond a right line with the metacarpus, and we can bend them to more than a right angle. The metacarpal bones are so connected by ligaments and muscles, as to prevent these ends separating from one another, and spreading, when we grasp convex bodies; and the end of the metacarpal bone, which supports the little finger, has a powerful apparatus of muscles expressly allotted to it, to keep it firm, in opposition to the power of the thumb, when we grasp bodies with force.

The bones of the fingers are made a little convex behind, but flat in front, for the convenience of grasping. The second and third joints of the fingers are formed into hinges, admitting only of flexion and extension. The last bones of the fingers are very small, the nail causing the apparent breadth of the end of the finger.

The thumb consists of three bones, the first of which is articulated to the carpus, and the joint appears like a hinge, though from the looseness of the ligaments, it admits of a small degree of motion in very various directions; which motions appear more considerable than they really are, when their effect is observed, as the extremity of so long a radius as the thumb makes. In consequence of this freedom of motion, we are enabled to apply the end of the thumb to each of the fingers and to different parts of the hand, and also to place the thumb in direct opposition to the power exerted by the whole of the fingers and hand, in grasping. The second joint of the thumb resembles the first joint of the fingers, not only in the form of the bones, but also in the arrangement of the ligaments, which limit the motions nearly to those of a hinge, and the last joint of the thumb, is like either of the two last joints of the fingers, a perfect hinge.

The fingers and thumb are of unequal length, and, on this account, they are peculiarly adapted for grasping spherical bodies which are most difficult to seize and to hold. If, for instance, we take hold of a pocket globe, placing one of its poles in the hollow of our hand, we find all our fingers and

the thumb opposing each other upon some parallel of latitude, and thus giving the greatest security to our grasp.

When the elbow-joint is fixed, the hand describes a complete semicircle, in pronation and supination; and the extent of its motion, in these directions, may be increased by variations in the position of the elbow and shoulder. As the hand moves through a yet more considerable portion of a circle in the utmost flexion and extension of the wrist, as it admits in all these motions of being carried to one side or the other, it is obvious that we can take hold of bodies in any point of the very considerable area, the circumference of which, the hand is competent to describe, when the other joints of the arm are moved to their greatest extent. The excellence of the mechanism of the pectoral extremities of man is proved by its results. The structures are so strong, and the powers so great, that we can seize, and hold, and pull, and push, and strike, with great power, and in such surprizingly varied directions; and yet the joints and powers are so nicely formed and adjusted, that we can also take hold of the smallest objects, and guide them with the greatest gentleness, nicety, and diversity of motion, by which means we are enabled to model and design the minutest objects.

The weight of the head, arms, and upper part of the body rests, as has been shewn, in equilibrio on the bone which supports the base of the vertebral column. This wedge-shaped bone is called the os sacrum, they say, because that part of the animal was frequently offered in sacrifices. It is very broad above and narrow below, so that the weight which it supports would only tend to depress the broader part of the wedge into the narrower space, and render the fabric more secure. The sacrum is convex behind, and concave in front, for it forms a part of a somewhat circular bony cavity placed at the bottom of the belly and called the pelvis or basin. The sacrum terminates by a smooth surface of small extent, and oblong in the lateral direction, on which there moves backwards and forwards a little bone which is called the os coccygis, from its supposed resemblance to a cuckow's beak. This bone is occasionally thrust backwards, but is usually held forwards by muscles connected to it, and affords the last bony support for the weight of those bowels which may gravitate into the cavity of the pelvis in particular positions of the body.

This little bone is analogous to the tail of animals, which is moveable on the end of the sacrum, and composed of many

pieces of various form in different animals. I mention this merely as one of the proofs, though it is far from the best, of the uniformity of the plan, and the diversity of the means and ends we observe in the construction of animals. The tail very commonly serves to animals the purposes of a switch, a balance, and a rudder. It is, however, a hold-fast in such as possess the *cauda prehensilis*, whilst to the kangaroo it is a prop and a leaping-pole, and to the beaver it serves as a trowel.

The sacrum derives support from the two side bones of the pelvis, by extensive surfaces, which converge as the wedge diminishes. These bones form a kind of circle, and are united with each other in front, and thus is the bony circumference of the pelvis completed. The back part of the circle being continued from the sacrum, forms an arch on which the weight of the body is supported. No one can, I think, view this part of the skeleton without being struck with its architectural construction. The wedge forms the key-stone of an arch, on which, not only the weight of the upper part of the body, but also of those loads which we occasionally sustain, is supported. The side bones are expanded above the brim of the pelvis forming the hips, and give support to the viscera contained in the belly. The hips are much more expanded in females than in males. The ancients, who had a clear and strong perception of whatever is beautiful and useful in the human figure, and who, perhaps, delicately exaggerated beauty to render it more striking, have represented Venus as measuring one-third more across the hips than the shoulders, whilst in Apollo, they have reversed these measurements. The lower part of the side bones are formed into oblique protuberances, upon which we sit, and here we have a fatty cushion to rest upon. These prominences are placed parallel to the line of gravity, so that when we sit upright upon them, the weight of the body is here again found to be in a state of equipoize. The cavity of the pelvis in the human subject, is not placed as it is in brutes, in the same direction with that of the belly. Were it so, the contents of that cavity would be continually gravitating towards its inferior aperture. Even the pelvic viscera cannot be said to gravitate towards the inferior aperture of the pelvis, in the ordinary positions of the body; whatever presses in that direction must be protruded.

The weight of the whole upper part of the body is transmitted from the arch described by the bones of the pelvis, to

a second arch, made by the form of the heads and necks of the thigh-bones. Their heads, which are very perfectly rounded, making a considerable portion of a sphere, are lodged in deep cups, the brims of which are particularly high in the upper and outer part, where the re-action of the ground against our descending weight, would ordinarily tend to dislodge them, had not such an occurrence been thus guarded against. These cups are placed a little in front of a perpendicular line let fall from the top of the sacrum. As the weight of the greater part of the pelvis, and of the muscular buttocks is placed behind the sockets, so when we stand upright, the whole of the incumbent weight is perfectly balanced on the rounded heads of the thigh-bone, and the most trivial variation in the direction of the weight occasions the body to incline towards that part, at which it takes place.

The hip-joint is the most complete ball and socket joint in the human skeleton, and the socket can move upon the ball with the most perfect facility, and with the nicest gradation and variation. Thus, when we stand upon one leg, we have the power of balancing the weight upon the rounded head of the thigh-bone. There are two modes of balancing, either by moving the incumbent weight upon the area of support, or by moving the basis of support under the incumbent weight.—By the connection of our lower extremities with the pelvis, we possess the ability of balancing our weight in both these ways. No better demonstration of this need be given, than what is exhibited in those amphitheatres, where feats of horsemanship are displayed. We there see a man stand with one foot on the saddle, and maintain his balance, when his horse is at full speed. This he does when his body is placed horizontally, and with one arm and leg extended in opposite directions. To maintain so perfect a balance, it is necessary that the weight of the body should move in various directions, and with nicely adjusted gradations upon the head of the thigh-bone, and also, that by the motions of the knee and ancle, the support should be equally varied under the incumbent weight.

The weight of the body is transmitted from the arch of the pelvis, to a second arch made by the form of the heads and necks of the thigh-bones, the basis of which rests against the side of the bone near its top, and protrudes that part of the bone outwards, and the bottom in a contrary direction, so as to bring the knee-joint nearly under the general line of gravi-

ty of the whole body, and from this joint, the weight is transmitted in a perpendicular direction upon the arch of the foot.

I must not dwell upon the form of the bones or the structure of the joints in these pelvic or lower extremities, lest I should set my audience asleep. Suffice it then to say, that when the knee-joint is extended so that the leg makes a perpendicular line with the thigh, and the ankle bent, so that the foot forms a right angle with the leg, each of these joints is rigid and immoveable. Such is their position when we stand; the whole limb forming a pillar for our support, and no motion can take place but at the top or bottom, at the hip or foot. But when the knee is bent, and the foot stretched out, as happens in progression, the same joints are loosened, and a lateral motion admitted, which is useful in the direction of our steps. The knee is secured in its extended state, so necessary for our support, by muscles which are incomparably the strongest in the whole body; and which hold the kneepan elevated to the top of a pully formed in the front of the joint. But when the muscles are weak, then indeed are "the pregnant hinges of the knee disposed to crook," and yield to the incumbent weight. By the same muscles we are let down easily into our chairs, and they are the agents which raise us up again.

There are those who, having by habit preserved the motion of their joints to the greatest extent, and of their muscles to the greatest degree of action and yielding, can lower themselves gradually so as to sit upon their heels. These muscles therefore are employed to break our fall, if it takes place in the most dangerous direction backwards. The strong muscles in front of the body, more potent from the lever with which they operate, being attached far before the centre of gravity, also concur in bringing forwards the chest and head, and protecting them from injury. We see children, when in danger of falling backwards, by these means suddenly sit down upon the ground. Nature has also formed the lower limbs of children, whose powers are feeble and unpractised in balancing, so short as greatly to diminish the risk of injury from falling. Most young animals are formed with short limbs apparently for the same reason. Such formation, however, cannot be considered as the result of necessity, for when the mother suckles her young, whilst standing, their limbs appear of a preposterous length. When we fall forwards, we fall as a quadruped stands, our outstretched arms protecting the upper part of the body, and our bended knees the lower.

When we stand on one leg, the weight of the whole body, as well as of those loads which it occasionally sustains, is transmitted by the bones of the leg upon the arch of the foot, which is very convex, and well adapted for its support, from whence it is transmitted to the heel behind, and to the ends of the metatarsal bones which form the first joints of the toes, so that it rests upon the ground. Chiefly, however, the weight is supported upon the ends of the metatarsal bones belonging to the great and little toe, which have a strong apparatus of muscles to keep them steady and preserve them in their relative situation to the heel. Thus is our weight supported on an arch and transmitted to the ground by a tripod: forms well known to be best adapted for giving support and security of position. Nature, however, gave us powers of grasping with our feet, and thus further securing our position, but these we in general lose for want of using them. They say, a Chinese will sit perched upon a ship's boom when it swings to leeward; and it is recorded, that Milo could stand with one foot on a quoit, and no man in Greece could push or pull him off. If this be true, he must have been not only a very strong man, but a very heavy one, and a most expert balancer.

The arch of the tarsus, like that of the carpus, can also resist the effect of forces when applied against it sideways. We can walk on the ends of the metatarsal bones, and in that case, the short toes do but seem to increase the extent of surface on which we are supported. This security against injury in this direction, is further manifested in quadrupeds; for the tarsus is the structure of the second apparent joints, in their pelvic or hind limbs, joints which correspond to the carpus in front, and which are usually called the hocks. In those animals that leap to great heights or distances, the os calcis projects, so as to form a most enormous lever, and we judge of the animals powers by observing this projection.

Such is the mechanism of our lower limbs, nor need I endeavour to shew its excellence, by the effects resulting from it. Every one knows from what heights we can leap, to what heights we can spring, and to what distances we can bound, without injury; as well as how swiftly we can run, how firmly we can stand, how nimbly we can dance, and how perfectly we can balance ourselves upon the smallest surfaces of support. Yet there are a few circumstances, which, I think, deserve consideration. Gravitation seems to be the chief cause which gives fixity of position to some parts, and consequent freedom of motion to others. When we stand upon

one limb, we balance our weight upon the head of the thigh bone, and no effort is required to maintain our position, but what is necessary to secure the knee and ankle joints in that state in which they admit of no motion.

Thus standing, all the other limbs are free to move, and can be moved with great power, because they are connected to a perpendicular column which owes its stability to its great weight. In the sculptured figures of the ancients, if a man is represented standing on one leg, he seems as firmly fixed to the ground as a fast-rooted tree; and associating freedom and power of motion with this stability, we seem to expect the continuance of that action, which the figure is represented to have begun. When we stand upon both legs, we can transfer the weight from one to the other, with very little variation in the position of our bodies. The oblique direction of the thigh bones, the consequent approximation of the knees, and the transmission of the weight, in a perpendicular direction on the arch of the foot, seems to me designed to give us this facility.

In progression, the supporting limb should be perpendicularly under the centre of gravity of the whole body, and the advancing one is brought forwards in a curvilinear direction. This course is the result of the rolling of the head of the thigh bone in its socket, and by it the advancing limb is brought forwards without striking the other, and carried to a position in which it is more directly under the centre of gravity of the body, when that is also brought forwards, than it would have been, had the limb moved in a straight line. The free and firm step of the soldier is the result of the circumstances I have mentioned. We are more struck and convinced of this, by observing that caricature of marching which is exhibited by opera dancers on the stage, for these gentry will raise the advancing limb above a horizontal line drawn from the front of the pelvis, and, performing sundry evolutions with the foot, will afterwards gently deposit it where it ought to be placed in ordinary progression: afterwards, throwing the weight of the body perpendicularly upon it, they exhibit the same extravagancies with the other limb. All which we deem elegant, because we associate the idea of elegance with security of support obtained without effort. As a contrast to such progression as I have described, I request you to observe, that of a very fat man, who walks with his legs far apart, and you will see that he is obliged to shift the weight of his body from

one leg to the other, by a considerable degree of lateral motion of the body at every step he takes.

All the large muscles that act upon the thigh bone, turn it, and consequently the whole limb outwards, so that it appears evidently the intention of nature, that we should walk with our feet slightly turned to that direction; but I will not detain you, by shewing in what various ways this position of the limb contributes to the facility of our motion, and the security of our support.

Yet there is one circumstance I may mention, though it relates to a subject rather curious than useful. There appears amongst men, as amongst horses, two distinct forms, one calculated for strength, the other for speed or agility. The former is chiefly characterized in man by the shortness of the neck and loins, the greater proportionate breadth of the shoulders, the broad and highly arched foot, with a much projecting heel. The latter is distinguishable by the length of the neck and loins, the length of the thighs, by a narrower and longer foot, with a less projecting heel. Persons of the form that indicates strength are generally shorter than those of the other figure, so that we associate an idea of the height of a person with his make. This subject was remarked by Hogarth, who says, that if the figures of Quin and Garrick were represented of the same size, an observer would suppose Garrick to have been a tall man, and Quin a short one. Yet the contrary being the fact, he accounts for the deception, by saying, that Quin was a tall man of short proportions, and Garrick a short man with tall proportions. The Farnesian Hercules is an admirable representation of the strong form of man, but no one can observe the figure without at once perceiving, that it is far better calculated for cleansing the Augean stables, than for catching the stag of Œnoe.

Many of the bones which compose the skeleton are connected together without admitting of motion upon one another; and in this case, portions of elastic gristle are interposed between them to prevent jarring, and they are tied together by unyielding and exceedingly strong ligaments. When bones move upon one another, when a true joint is formed, the corresponding surfaces of each bone are covered by gristle, which is exquisitely smooth or polished. Between these smooth surfaces, aliquor, like the white of eggs, is effused to prevent their adhesion, and to facilitate their motion. The escape of this synovial liquid from the joint is prevented by capsules; and the bones are firmly tied together by liga

ments of surprizing strength, which are so contrived as freely to admit those motions that the bones are adapted for, and to prevent any other. All the parts composing the joints possess so little natural sensibility, that notwithstanding the violent pressure and rapid motion they undergo, we are scarcely sensible of the parts, at which such motion is effected.

I feel that some apology is requisite for detaining your attention so long upon circumstances familiarly known, but not in general sufficiently contemplated, which I have been induced to do, because we are far better judges of the causes requiring mechanism, and the effects resulting from it, than we are of the vital processes. Therefore, from this least interesting part of anatomy, we derive the strongest conviction of there being design and contrivance in the construction of animals. Equal evidences of design and contrivance, and of adaptation of means to ends may be observed in the construction of the frame-work, as I may call it, of other animals, as in that of man, which subject seems to me very happily displayed in Professor Cuvier's lectures. Yet there are some who presume to find fault with the mechanism of the human skeleton. An excellent anatomist once said, there was not a well made joint in the whole body; but he was then talking as a carpenter, like one who had no means of judging of the works of nature, but by comparing them with our own limited designs and performances. It was however the comparing the mechanism of the hand and foot that led Galen, who they say was a sceptic in his youth, to the public declaration of his opinion that intelligence must have operated in ordaining the laws by which living beings are constructed. That Galen was a man of very superior intellect could be readily proved were it necessary. I have often known the passage I allude to, made a subject of reference, but not of quotation, and therefore I recite it on the present occasion, and particularly because it shews that Galen was not in the least degree tinctured with superstition. "In explaining these things," he says, "I esteem myself as composing a solemn hymn to the great architect of our bodily frame; in which I think there is more true piety, than in sacrificing hecatombs of oxen, or in burning the most costly perfumes; for I first endeavour, from his works, to know him myself, and afterwards, by the same means, to shew him to others, to inform them how great is his Wisdom, his Goodness, his Power."

There are, however, other structures in the body besides what I have just denominated the frame-work. Doctor Hunter could never demonstrate the back part of the human throat, the passages by which we swallow and respire, and the mechanism, by which the extremely diversified intonations of the human voice are produced, without enthusiasm. Who, also, can examine the lachrymal parts of the human eye, without admiration? But why do we admire these things? Is it not because we understand them? We see the necessity for contrivances, and we find them constructed beyond our highest expectations, and perfectly adequate to effect the purposes for which we believe them designed. The same conclusion, must, therefore, in reason, be drawn from the examination of the structures we meet with in living beings, as that which has been deduced from the consideration of the works of nature in general, by the most intelligent and best informed men. That what we understand, seems excellent in a degree far exceeding our ordinary conceptions, yet appearing more and more so in proportion as it is minutely examined and attentively considered; and that we understand so much of the works of nature, as to warrant us in concluding, that we can only cease to admire, when we fail to understand.

LECTURE IV.

ON DIGESTION.

THOSE bodies which we call living, are chiefly characterised by their powers of converting surrounding substances into their own nature; of building up the structure of their own bodies, and repairing the injuries they may accidentally sustain. They not only differ considerably from each other in their size and external form, but also in their internal structure. Vegetables imbibe watery fluids from the earth, in which saline and other matters are dissolved or suspended, and these, in the very vessels of the vegetable, become the sap or nutritive fluid of the plant. This ascends with celerity and force; forms the leaves, flowers, and fruit, in which it is more particularly exposed to the influence of light, heat, and

air; then returns and augments the woody stems and trunk, impregnates them with juices which concrete; and eventually descends to the roots, to nourish and increase them, and in various instances, to form means and materials, for the future production of vegetables of the same kind.

Such is the view of the nourishmet of vegetables, exhibited of late by Mr. Knight, in his papers published in the Philosophical Transactions, and which has been drawn from the results of numerous well contrived and satisfactory experiments. The ascending sap has in it no marked peculiarity, being equally fitted to form the leaf, the flower, and the fruit; for he has engrafted the stalk, upon which each of these has been produced, upon the same kind of stem. Also, by dividing the descending vessels, he has stopped the formation of the parts below; and by performing this experiment in the root, he has prevented the growth of the potatoe, and even caused it to be injected from these descending vessels by which it is formed and supported.

In viewing the subject, according to this sketch, we cannot but feel surprize, that the vessels of plants should imbibe the raw juices of the earth, however impregnated, and so suddenly convert them into sap, which is a very peculiar fluid; for it seems a more wonderful kind of digestion than that which takes place even in the stomachs of animals. Here, however, the experiments of Mr. Knight seem to aid our conceptions, by shewing, that the returning vessels impregnate the plant with juices, which concrete, and are probably dissolved in the ascending watery sap, enriching it with nourishment, and it may be, chemically aided in its formation. Mr. Knight finds that the specific gravity of the wood of trees, is diminished by the ascent of the sap. Thus, when the genial warmth of the spring excites those actions which imbibe the juices of the earth, and cause the ascent of the sap, the plant seems bursting with life and nutriment. The leaves bud in every part, and are formed with surprizing celerity. When, however, the tree has attained its full extent of annual growth, the returning sap is more especially employed in storing the interstices with materials to serve for nourishment in the succeeding spring; and to this Mr. Knight attributes the increased specific gravity of wood felled in the winter season.

It is in the leaf, however, that the distributed fluids of plants seem to undergo their chief elaboration; for here they are more freely exposed to the influence of light, heat, and

air; much, also, is manifestly thrown off by perspiration; and much is probably added, so as to render these juices competent to form, under the agency of the vital energies, that extreme diversity of substances which we meet with in the leaf, the flower, the trunk, and the roots.

In animals, the matter by which they are nourished, is in general taken into a receptacle or stomach, where it undergoes a process called digestion; and so analogous are the functions of life in vegetables and the lower kinds of animals, that Mr. Hunter considered this circumstance as the chief criterion of distinction between the two classes. I believe him to have been the first person who broached and established the now generally received opinions respecting digestion. His observations and reflections suggested to him, that the liquors secreted by or poured into the stomach, had the surprizing power of dissolving the dissimilar food by which different animals are nourished, and of converting it into a substance *sui generis;* this being the first and most important step to sanguification, or its ultimate conversion into that nutritive fluid which is distributed to every part of their bodies, for their formation and support.

Mr. Hunter knew that the gastric fluids were neither acid nor alkaline, nor endowed with any predominant quality, such as would induce us to suppose they had these wonder-working powers. He was fully apprized of the variety of substances from which different animals thus derive their nourishment. He mentions that the voracious caterpillar which eats such quantities of the leaves of plants, digests only their juices, and voids the leaf dry, which will afterwards unfold itself in warm water as tea-leaves do. He knew that the fibrous matter of vegetables, and the husks of grain, are in general not susceptible of digestion by the gastric fluids; and yet that some insects live upon them. Indeed they first pour upon the woody substance a liquor which dissolves it, and in this state they swallow and digest it.

Thus also does that foe to literature, the book-worm, make his way through the most massy folios, solving the most difficult passages, and digesting all as he proceeds. Indeed he pours his sauce, or cooking liquors with such profusion, as to tinge and affect the texture of the leaves to some distance round the circumference of the tunnel which he

makes. Some creatures also thrive best upon animal substances in a disgusting and noxious state of putrefaction. Therefore it is evident, that life can, by means of the fluids it prepares, convert to its own purposes substances which are ordinarily most innutritive or pernicious.

Although the gastric fluids have no sensibly distinguishing character, yet Mr. Hunter knew that they not only coagulated milk, but white of egg, and other nutritive fluids; thus first rendering them solid, that they might be detained in the stomach till they underwent the peculiar solution, called digestion.* He knew that the gastric fluids checked and prevented the natural decomposition of animal and vegetable matter; that if putrid meat were swallowed by a hungry dog, it quickly lost all fœtor, and that no fermentation or putrefaction of food ever takes place in the stomach, if the gastric juices be healthy; therefore it followed that digestion could not be the result of any common fermentative process. Nay, he further knew that the gastric fluids sometimes dissolved even the stomach itself. Mr. Hunter could not wonder that such an event did not more frequently take place; for when persons die of disease, the gastric fluids have not for a long time been prepared, or they have been of an unhealthy quality, so that they are incompetent to dissolve the smallest quantity of the most digestible food, if taken into the stomach. Mr. Hunter could never wonder that the gastric fluids did not act upon the living stomach, for he full well knew that life was a chemist which regulated its own chemical operations, and controlled the effect of foreign chemical agency. He was, I believe, the first who plainly told the public, that chemical agents do not in general act upon living, as they do upon dead animal matter. He knew that worms live in the stomach, and yet that a meal of dead worms would form no innutritive repast to an hungry dog. He must have known also that the peculiar fluid which digests the food is not secreted at all times, but only when the stomach is excited by the stimulus of food, and even then but under favouring circumstances. If in this state persons are suddenly killed by accident, the gastric fluids will continue for some time to act, not only upon the food, but also upon the stomach itself, so as to form a large aperture by which the fluids escape.

* He says he had examined this subject, and found the coagulation to take place in the various kinds of animals, downwards as far as fish.

Having reflected upon all these circumstances, and made numerous experiments on the subject of digestion, we find him afterwards employed to open the body of a patient (who died when attended by Sir John Pringle, then President of the Royal Society,) in which a partial solution of the stomach had taken place. The appearance was to Sir John both new and unaccountable; but when Mr. Hunter told him that it was not the effect of disease, but of solution by the gastric fluids; that he had frequently seen it, and that it made one of the reasons which induced him to believe digestion to be the effect of a solution of the food by the gastric fluid; the president urged him to draw up a paper on the subject; which was printed in the year 1772, in the 62d volume of the Philosophical Transactions. This paper attracted the attention of Spalanzani and others, and led them to make and publish experiments tending to demonstrate the fact, which is thus announced in the conclusion of Mr. Hunter's observations; "that digestion neither depends on mechanical powers, nor contractions of the stomach, nor on heat;* but on something secreted in the coats of the stomach, and thrown into its cavity, which there assimulates the food to the nature of the blood."

As, however, Mr. Hunter, in a second paper on digestion, has published his own commentary on the proceedings of those, who may be said to be his coadjutors in the proof of the fact, but who might appear to himself and the public as competitors in the discovery, I need not say any thing respecting this subject. Yet there is one point which I feel it a duty to advert to. Mr. Hunter, whom I should not have believed to be very scrupulous about inflicting sufferings upon animals, nevertheless censures Spalanzani for the unmeaning repetition of similar experiments. Having resolved publicly to express my own opinions with respect to this subject, I choose the present opportunity to do it, because I believe Spalanzani to have been one of those who have tortured and destroyed animals in vain. I do not perceive that in the two principal subjects which he sought to elucidate, he has added any important fact to our stock of knowledge: besides, some of his experiments are of a nature that a good man would have blushed to think of, and a wise man would have been ashamed to publish; for they prove no fact requiring to be proved, and only show that the aforesaid Abbe was a filthy-minded fellow.

* He might have substituted the word fermentation, for heat, for it would more plainly have conveyed his meaning.

The design of experiments is to interrogate nature; and surely the enquirer ought to make himself acquainted with the language of nature, and take care to propose pertinent questions; he ought further to consider the probable kind of replies that may be made to his enquiries, and the inferences that he may be warranted in drawing from different responses; so as to be able to determine whether by the commission of cruelty he is likely to obtain adequate instruction. Indeed before we make experiments on sensitive beings, we ought further to consider whether the information we seek may not be attainable by other means. I am aware of the advantages which have been derived from such experiments when made by persons of talent, and who have properly prepared themselves, but I also know that these experiments tend to harden the feelings, which often leads to the unnecessary and inconsiderate performance of them. Surely we should endeavour to foster, and not to stifle, benevolence, the best sentiment of our nature, that which is productive of the greatest gratification and advantage both to its possessor and to others. Considering the professors in this place as the organs of the court of the college; addressing its members, I feel that I act as becomes a senior of this Institution, whilst admitting the propriety of the practice under the foregoing restrictions, I at the same time express an earnest hope that the character of an English surgeon may never be tarnished by the commission of inconsiderate or unnecessary cruelty. I need not, Gentlemen, caution you, who must feel anxious to maintain the respectability as well as the reputation of the medical character, against publishing experiments disgusting to common decency.

Now though Mr. Hunter clearly perceived that liquors could be and were prepared, possessed of surprising powers of assimilating the food to the nutritive fluids of the animal, he was likewise equally apprized of the variety of means which nature has instituted to prepare the food for digestion, and facilitate the action of the gastric fluids. With this intention, some animals are made to grind or comminute their food with their teeth, but this is not essential to the function of digestion, neither does it take place in the majority of animals. Therefore Mr. Hunter seems, in his Museum, to have placed the teeth amongst the weapons and instruments which are allotted to animals.

Many carnivorous animals, he observes, divide their food no further than is necessary to enable them to swallow it; and all animals whose food requires this degree of subdivision

must have means to effect it. Mr. Hunter has shown that cuttle-fish have beaks like birds; and that worms have osseous teeth fixed in the fleshy circles that form their mouths. He has placed the preparations which show these and similar facts in a department of his Museum, allotted to show peculiarities belonging to individuals of any species or genus of animals, which do not belong to others of the same kind; and not among the preparations displaying the anatomical facts relating to digestion in general. Mr. Hunter studied anatomy as a physiologist, he investigated structure in order to understand function, and he has omitted to record or exhibit many anatomical facts, with which he doubtless was acquainted, because they did not seem to lead to a physiological conclusion.

Herbivorous animals in general grind their food with their teeth; nay, those who spend a life of leisure and repose, are made to ruminate or remasticate their food, whilst other vegetable feeders, and I may cite the horse as a familiar instance, whose life is probably destined to more continual exertion, do not ruminate. The horse however has a constant propensity to feed, and the food passes readily from his small stomach; therefore, he would waste a great deal of food, had not Nature provided him with most capacious intestines, and contrived to produce a kind of second stomach and digestion in that part of the bowels called the intestinum cæcum.

Mr. Hunter was fully apprized that many of the insects of the lower kinds of animals and some fish, have teeth of various sorts fixed in their stomachs to divide and comminute their food. He was convinced that birds do not swallow stones from mere stupidity as Spalanzani supposed, but to serve as temporary teeth, or as mill-stones to grind their food under the operation of their powerful gizzards. In his paper on the stomach of the gillaroo trout, he says that, "the English trout swallows shell-fish, and also pretty large smooth stones, which serve for shell-breakers." He also says, "the mullet has a stronger stomach than the gillaroo trout, but that they have neither the power, nor motion, nor horny lining of true gizzards."

Gizzards, like teeth, serve to subdivide the food, and thereby increase the surface on which the gastric fluids may act so as to facilitate its solution. Though birds in general have gizzards for this purpose. Mr. Hunter knew, that those which feed on flesh have them formed with their muscular and inter-

nal coat so thin, as scarcely to be recognizable for such organs. By feeding a rook with bread, he found that the muscular power of his stomach became much increased, and its lining much thickened and hardened; a fact corresponding to many other observations he had made, showing that the vital powers could alter the organization of parts, so as to adapt them to exigencies.

Another mode of preparing food for solution by the gastric fluids, is by a kind of maceration, generally in warm and moist places, a kind of cooking process, for which probably the complex stomachs of ruminating and other animals are designed. In ruminating animals which have four stomachs, the first or paunch, is a reservoir from which the food is thrown up to be remasticated; the fourth digests the food; but the exact function of the intermediate stomachs is unknown. Mr. Hunter has not omitted to display the contrivance by which in the calf, the milk is made to pass directly into the fourth stomach for digestion, without entering the others. The crops of birds and various other animals are also to be considered as macerating pouches, and which gradually supply materials for the operation of the gizzard. Their contents are likewise sometimes regurgitated, for thus does the bee store its cell with honey, and some birds feed their young.

Mr. Hunter was fully apprised that many of the insects, and of the lower kinds of animals have complex stomachs, crops, and gizzards; and he has shown these facts among the peculiarities to which I have already referred.

That digestion, or the solution of the food by the gastric fluids, takes place in some particular district, and not elsewhere, is, Mr. Hunter says, to be inferred, from observing that in fish and serpents, which swallow more prey at once than the stomach can contain, that portion of their food only, which is in the stomach, is dissolved, whilst that which is in the gullet undergoes no such change. Also, from observing that the yolk of the egg, which is conveyed into the intestines of the chicken, ascends into the stomach before it can be digested, Mr. Hunter was fully apprized, that parts of a single stomach might secrete the solvent liquors, and not the whole bag. He observes, that part of the stomach in several animals, is covered by cuticle, like the first, second, and third stomachs of those which ruminate. This occurs in the peccari, hog, rat, and horse. The fact of digestion occurring partially in the stomach, he says, is also evident in that of a

dog, into which a large piece of meat has been swallowed at once. Towards the great end, the food will be found but little altered, towards the middle more, and towards the pylorus it will be similar to that which is found in the duodenum. Mr. Hunter was apprized, that the duodenum in some animals, might be considered as serving to digest the food; for it is formed of considerable capacity, resembling a stomach, and is chiefly recognized by anatomists as that intestine, in consequence of the biliary and pancreatic ducts terminating in it. He also perceived, that when the pylorus is not detentive, the gastric fluids might flow into the duodenum, and there complete the process of digestion.

The solvent liquors are secreted from the lining of the stomach, or sometimes poured into it from glands situated at its upper opening. The latter is commonly found in birds, because the lining of their stomachs is formed for trituration, and consequently not for secretion. Yet the same kind of structure is met with in other animals, and even among quadrupeds as in the beaver. According to Mr. Hunter's notions of secretion, it must have appeared to him a subject of no importance whether the gastric liquor was secreted by particular glands or otherwise; for secretion is an universal function, and can take place as well from surfaces as glands. He was indeed anxious to note every variety of structure, and, as I believe, also in order to observe whether any thing could be found contradictory to his opinion that the several vital functions were the result of the actions of a principle distinct from the organization in which it adhered.

It must surely be curious and interesting to all, to be informed, that his opinions respecting secretion, opinions at the time which seemed almost inexpressible to himself, and incomprehensible to others, have been most perfectly verified by experiments subsequently made with a view to determine facts relative to digestion. Mr. Hunter thought that a subtle principle of life was diffused throughout the body, that it inhered in the solids, and was the cause of their different vital affections; that it pervaded certain fluids, which it could either modify, decompose, or recombine, and thus produce the extreme variety of new substances, that may and do result from one kind of nutritive and universally distributed fluid. He had no mode to express the idea; nor could any one discover a better than by saying, that specific and peculiar actions will produce specific and peculiar secretions. I have already told you, Gentlemen, how these terms were

cavilled at. Mr. Hunter thought, that the vital principle was particularly accumulated in the brain, in those animals which possessed such an organ, and that it seemed in them a kind of source of vital energies, and that the nerves were internunciate chords, by which the affections of life were reciprocally communicated. The verification of Mr. Hunter's opinions must interest all, because they show how justly we may infer causes, by the industrious observation, and patient and accurate contemplation of effects; and therefore the result is creditable to human intellect, and gives us confidence in other opinions which are thus deduced. I shall briefly relate the experiments to which I have just alluded.

Doctor Haighton, after having fed a hungry dog whose stomach was empty, with flesh meat, divides the eighth pair of nerves which go from the brain, to be distributed to the stomach, and thus prevents or disturbs those vital actions, which are necessary to the preparation of the gastric fluid. Consequently, when after many hours, he kills the dog, he finds the food in the stomach perfectly undigested, and but little changed. He performs a similar experiment, but only divides one of the nerves of the eighth pair, and the dog becomes dyspeptic, having eructations and manifest uneasiness about the stomach; which symptoms continue for several weeks: and though the dog eats the food which is given to him, he becomes much emaciated, yet gradually recovers, as the divided nerve re-unites and resumes its functions. In like manner, Mr. Brodie having observed, that the administration of arsenic was uniformly followed by profuse secretion of mucus and watery liquors into the stomach, divides the nerves of the eighth pair in dogs, and then administers the poison, but no secretions are afterwards effused into the stomach.*

Professor Harwood of Cambridge gives to two dogs, equal in age, health, and appetite, equal quantities of flesh meat. They were pointers: and he suffers one of the dogs to do what nature indicated to be favourable to digestion, to lie down by the fire and go to sleep; but he entices the other into the fields, and causes him to hunt about for game. After some hours he kills both dogs, and finds the food in the stomach of the dog which had been kept in constant exercise, undigested and but little changed; whilst in the other it had, in the same time, not only been digested by the stomach, but converted

* Philos. Trans. 1814.

into chyle by the intestines, and was rapidly passing through their absorbent vessels in the high road to the sanguiferous system.

No one is disposed to doubt the results of these experiments, for every one is more or less convinced, by his own feelings, that affections of the mind, and bodily exertion, will, by disturbing or otherwise occupying the nervous energies, diminish or prevent appetite and digestion.

The pylorus, or opening by which the stomach communicates with the intestinal tube, is variously formed in different animals, allowing or preventing, in various degrees, the transit of alimentary matter. In the human stomach it is a small circular and muscular aperture, admitting of occasional dilatation, so as sometimes to give passage to a body of the diameter of half a crown, yet ordinarily so contracted as to detain even fluids in the cavity of the stomach; else how could we distend it with liquors as we sometimes do. It may be useful to mention a case which serves to illustrate the degree in which such detention may occasionally occur. A miserable woman took opium during the night in St. Bartholomew's Hospital in order to destroy herself, and before she was noticed next morning her purpose was nearly accomplished. With scarcely any hopes, I injected into her stomach, by means of a varnished catheter introduced down the œsophagus from the right nostril, some lemonade, to which cordials and a solution of sulphate of zinc were added, in hopes of exciting the stomach and provoking it to vomit. Having injected in repeated doses what appeared to me to be a fully sufficient quantity, and waited till no hopes of success remained, I left the room. Some of the students, however, knowing the case to be desperate, injected more of the liquor, and when the body was afterwards examined, the stomach and gullet were found filled and distended up to the throat; nay, a small quantity of the liquor had actually overflowed the rima glottidis, and descended by the windpipe into the lungs. On the contrary, however, the pylorus in the horse gives ready passage to liquids, and even to the fibrous part of the food.

That animal will drink at once three or four times more water than his stomach can contain, which passes rapidly through his intestines till it arrives at his capacious cæcum, where it lodges.

He continues to eat in like manner, and the surplus of food must readily pass through the pylorus before it has been completely digested; on which account he would waste a great

deal of food, had not nature contrived to produce a kind of second stomach and digestion in that part of the bowels called the intestinum cæcum. Mr. Coleman, professor at the veterinary college, suffered a thirsty horse, which was to be killed, to drink as much water as he chose, and after six minutes, the alimentary canal being examined, it was found that the water had passed from the stomach through the small intestines, a distance of sixty feet, and was collected in the cæcum. Mr. Coleman supposes that nature has allotted to the horse but a small stomach, that the food might not, by being accumulated, impede the action of the diaphragm, and affect that free respiration which his speed of progression requires.

Having shown what Mr. Hunter knew and thought with respect to digestion, as carried on in cavities allotted for that purpose, it is proper to add, he was fully apprized that the same process could take place without the preparation and aid of solvent liquors.

Both analogy and observation warrant the supposition, that some animals have no digestive organs, and that their vessels, like those of vegetables, imbibe and distribute what becomes nutritious in the vessels themselves. No one has, I believe, seen digestive organs in the tenia; from various apertures we are able to inject different kind of vessels, so that this animal appears to be very vascular in every part, which is, I believe, as much as is known respecting its anatomy. In the fluke, also, whose food is gall, and which lives and multiplies in the biliary ducts of sheep, we see the gall imbibed from an orifice into a vessel which sends off branches to all parts of the animal, apparently becoming its distributive or nutrient vessel. If this be true, bile, which is formed from the blood of the sheep, is reconverted into the blood of the fluke, and forms the fleshy substance of this animal. It was one of the distinguishing characters, and greatest perplexities of Mr. Hunter's Physiology, that he asserted vessels could modify their contents, so that a kind of digestion may be said to take place every where by the immediate action of the vital powers. The structure of the last mentioned animals, as far as it is known, is exhibited in the collection; and the preparations were given to Mr. Hunter by Mr. Carlisle, who made them whilst a student.

The hydatid seems to be nourished in like manner. Analogy would induce us to believe that it was nourished, like vegetables, by absorption from without. Of its organization

however, we are perfectly ignorant, for no evident structure can be discerned, even by the aid of the microscope. These animalcules are found in the natural cavities, or in those formed in consequence of disease, in the bodies of other animals. We meet with them in the abdomen, in bursæ mucosæ, and in cysts in the brain, liver, and other organs. The form of one species is a globular or oval bag, which has an undulatory motion, when put into tepid water. The bag contains a transparent fluid. Young hydatids form upon the bag, are detached when very small, float about in the liquor of the cavities in which they dwell, to grow and to multiply as their parents have done. Now, in a physiological point of view, we must consider hydatids to be nourished by absorption from without, or suppose the bag to be a digesting cavity, though no aperture is discernible. In the department of the Museum allotted to display the structure of the digestive organs, Mr. Hunter has first put up some hydatids, as if to mark the uncertainty of our knowledge with regard to the nourishment of this and some other animals.

With such exceptions, all other animals have a digesting cavity, and the lowest orders appear to have no other organs, the whole interior being stomach, and the whole animal forming only the walls by which it is surrounded and supported, as is exemplified in actiniæ and medusæ. Mr. Hunter, in his MS. of the year 1776, writes as follows: "The apparatus necessary for digestion is as simple as any thing we can well conceive. It only requires a bag or cavity fit to contain the substance to be digested, joined with the power of furnishing the fluid capable of digesting the said substance. It is therefore to be considered as a gland and a cavity. Indeed, it is necessary, that another apparatus should be added; a system for absorbing the digested food and nourishing the bag, as well as preparing the fluid it secretes." Before this time, Mr. Hunter had injected the vessels of medusæ from the stomach with coloured glue, and their distribution is particularly beautiful. He was well acquainted with the fact that fluids may be imbibed from various apertures in the branches or members of these animals, and conveyed through tubes into a common cavity, which I merely mention to show that he was acquainted with that form of animal called rhizostome or root-mouthed.

As an evidence of an animal being little else than a stomach, Mr. Hunter has exhibited a specimen of the actinia associata. The mouth, which is surrounded by tentaculæ,

leads into a cavity, like the finger of a glove, the animal being no more than the substance which forms the walls of this cavity. Mr. Hunter, in his MS. proceeds to say, "that in some animals the stomach has but one aperture, serving equally to receive the food, and reject its residue. In others a distinct aperture is allotted for each of these functions. As the digestive organs become complicated, we find the stomach or digesting cavity has added to it an intestinal tube, in which the food undergoes still further changes; and this tube is also subdivided into two parts, and different functions are allotted to each. Glandular structures are also added, which prepare fluids subservient to the functions of the intestinal canal."

In the small intestines, the food is converted, in the higher order of animals, into chyle, which is a fluid very much resembling blood, and chiefly differing from it in its colour; so speedily and so nearly is the ultimate object of sanguification accomplished. The effect produced on the food in the intestines will be in proportion to the secreting surface of the canal, which pours on it peculiar liquors, and to the duration of its stay in the bowels. These objects are accomplished by the length and convoluted form of the canal; by its lining projecting and being formed into plaits, either transverse, longitudinal, spiral, or reticulated; by the formation of smaller fossæ or larger sacculi. Every variety in the animals hereafter mentioned is displayed, and so beautifully are the preparations injected, and so neatly put up, that these objects, which we generally view with disgust, attract the attention of strangers, who regard them as the most beautiful preparations in the whole collection. It is nearly at the commencement of the intestinal tube, that the bile and pancreatic liquors are poured into it. Mr. Hunter, in his paper on digestion, says "it appears from many experiments, that the digested or animalized part, when carried into the intestine, clings to the internal coat, as if entangled among the villi; whilst the excrementitious part and bile are found lying unconnected, in the gut, and as if separated from the other." This fact was more fully explained, and also exhibited in this theatre, by Mr. Astley Cooper, when he held the office of professor of Anatomy and Surgery to the College. He told us, that the gastric juices first dissolved that food which was most susceptible of digestion, thus affording an argument against much variety of viands; that the substance dissolved was discoverable in the solvent, and gave a character to the

solution; thus the chyle prepared from animal or vegetable substances partook of the nature of such substances, and if dried and burned, emitted the same odour, and produced similar results to those which occur from the decomposition of the same substances before they have undergone such solution. Nay, he told us further, that the chyle formed from animal matter rapidly putrefied, whilst that prepared from vegetables was slow in undergoing a similar change. As an abundance of nitrogen seems to be the base of animal substances, so its disposition to combine with hydrogen, and to form ammonia, seems readily to break up the general bond of union of the parts forming the compound. Whilst engaged in examining the chyle, he also examined the lymph which the absorbent vessels contain, and his chemical friends, who were men of great knowledge and ability, report, that it is in all respects like the blood, except that it wants the globular particles and colour of that fluid, a proof that these vessels, as well as others, modify their contents, which is a physiological subject I shall subsequently have to discuss.

Mr. Cooper showed us how firm a substance the digested aliment had become, and how tenaciously it adhered to the villous surface or lining of the intestines, so that it might be mistaken for a part of that surface; and how turgid the vessels of the intestines appeared when the chyle was separated from their villous coat, the whole surface appearing as if highly inflamed or subtilely injected. This he attributed to the digested aliment having acquired, in consequence of undergoing the process of digestion, the property which is characteristic of the blood; that of spontaneous coagulation, so as to become solid and tough, in which state the coagulum of either may firmly adhere to the surface with which it happens to be in contact.

The gastric fluids are detained in the stomach, and therefore not wasted, and the last mentioned circumstance interested me, because it showed how the succus intestinalis is prevented from being wasted, and its action confined to that substance which it is designed to convert into chyle, whilst the excrementitious matter alone remains loose in the calibre of the intestines, and at liberty to be urged on by their peristaltic actions. Nay, Mr. Cooper further showed us that the same circumstances also obtained in the large intestines, that portion of the alimentary matter which could be modified and rendered meet for absorption, acquiring an adhesive property and clinging to the surface, which accomplished these purposes.

It is well known that a great and sudden change is wrought in the contents of the alimentary canal, immediately on its transit from the small into the large intestines, that a valve is formed to prevent any communication between them in a retrograde course; that the commencement of the large intestines, usually called the cæcum, is in herbivorous animals particularly capacious, and apparently calculated for detaining the alimentary matter; and in some, as in the horse, this portion of the alimentary canal is of surprising magnitude; that the extent of surface of the lining of the large intestines is much more ample in herbivorous than in carnivorous animals. So that from these and other observations, it is believed that the residue of the alimentary matter undergoes a great change in them, produced by the qualities of the liquors they secrete, and that this change prevents a spontaneous chemical decomposition of the contents, and conduces to the extraction of whatever may be useful from the residue of the food. But I shall not detain your attention on this subject, because I have already briefly expressed my opinions respecting it. I omit many things, for I only attempt to explain what I believe were Mr. Hunter's opinions on certain points in physiology. Sir E. Home has already told us how industriously he noted the varieties of the formation of this part of the alimentary canal in different animals.

Though I must not proceed to describe in detail the facts which Mr. Hunter exhibits, with respect to the structure of the digestive organs of different animals, yet I shall mention in what variety they are displayed, because it will show you, in some degree, the extent of his researches in Comparative Anatomy; and also, because you will find the other vital organs, provided they admit of it, exhibited in the same animals, in all the different departments of the Museum. A great number of other animals will, however, be found in other departments, which are not included in this, for though such animals may exhibit interesting varieties in other vital organs, they contain no remarkable peculiarity in those concerned in digestion. Mr. Hunter examined the structure of echini, crustacea, and some molusca with particular attention, and caused drawings of exquisite beauty to be made of them. I take this opportunity to show you some of these drawings, and to inform you that there are probably one thousand of them belonging to the collection. Mr. Hunter was particularly fond of drawings and paintings, and consequently rather fastidious as to the representations given of the

objects in which he took so great an interest. There was no poor artist of talent in this town, that he did not befriend to the utmost of his power. Every man of genius was, indeed, his brother, and he felt a fraternal interest in his success.

Mr. Hunter has shown, in his Museum, the digestive cavities amongst—

ZOOPHYTES.

In polypes, actinia, zoanthus, and medusæ.

ECHINODERMATA.

Various echini, asteriades, holothuriæ, and sipunculus nudus.

INSECTS.

Gryllus cristatus, gryllo-talpa, œshna, musca tenax (Lin.), cicada, bees, beetles, silk-worm, termites.

CRUSTACEA.

Crabs, lobsters, and cray-fish.

VERMES.

Aphrodita aculeata, amphinome, nereis, terebella, lumbricus terrestris, hirudo.

ANIMALS INHABITING OTHERS.

Hydatigena, tænia, ascaris, echinorhynchi.

MOLUSCA.

Sepia officinalis, loligo, octopus, lepas aurita, and others. Coronula diadema, chiton, haliotis, doris, clio, bulla aperta, chama, pecten, mya, teredo navalis, ascidia intestinalis, clavata, salpa.

FISH.

Skate, torpedo, sturgeon, various sharks, tetraodon, lamprey, annarrhichas, (gillaroo trout), mullet.

REPTILES.

Testudo, lacerta agilis, gecko, alligator, rana, siren, lacertina.

BIRDS.

Swan, common pigeon, crowned pigeon, ostrich, cassowary of New South Wales, East Indian bittern, Solan goose, pelican, turkey, raven, rook, crow, and gull.

MAMMALIA.

Man, dog, lion, beaver, porcupine, hare, rat, ant-eater, manis, opossum, wombat, ornithorynchus, sloth, bear, peccari, hog, guinea-pig, calf, goat, elk, deer, camel, horse, various cetacea.

LECTURE V.

ON THE ABSORBING VESSELS.

NEXT to the organs which digest the food, there are displayed in the Museum those vessels which imbibe it from the bowels, and convey it, in the higher classes of animals, into the sanguiferous system.

Mr. Hunter, having convinced himself by observations and experiments which are published, that these vessels are the only ones which perform the function of absorption, attributed the removal of every thing in the interior of the body to these minute, highly susceptible, but undiscernible agents. Believing that secretion or deposition was a process very generally going on throughout the body, he used to call the absorbents, the modelling vessels, from perceiving that if secretion exceeded absorption in any part, increase of bulk and deformity would ensue. He was led on by degrees to believe, that these vessels, acting in excess, took away the very substance of which parts or organs were composed, so as to create large chasms in them. Seeing what things were done, and under what circumstances they took place, he was led to advert to the causes which excite or diminish the actions of these wonder-working vessels; but the advantages we have derived, in the practice of our profession, from the researches of Mr. Hunter with respect to this subject, have already been the theme of several lectures which I have had the honour of delivering in this theatre.

When his opinions on the functions of the absorbents were first promulgated, they appeared to others, not merely wild, but absolutely incredible; and when he was asked, how he could suppose it possible for these vessels to do such things as he attributed to them; he answered, nay, I know not, unless they possess powers similar to those which a caterpillar exerts, when feeding on a leaf. I relate this anecdote, merely to show that Mr. Hunter was one of those who could believe there must be means adequate to produce effects, though they were undiscoverable by our senses. It is interesting to know how generally opinions, which he first broached and established respecting the absorbents, are now received and adopted; for it is a striking proof of the facility and firmness with which we believe what is probable, when we have

no motive for contesting or denying it. All seem convinced of things scarcely explicable without requiring that kind of proof which some are accustomed to demand on other occasions.

The first preparation which Mr. Hunter has put up in this department of his collection is a common hyacinth root; which I cannot believe exhibits any thing more than may be observed with a glance of the eye, in the windows of our houses, during the spring season. We see the succulent roots descending from the tuber, and the leaves beginning to bud. I cannot believe that Mr. Hunter, or others, have ever seen the minute absorbing vessels which must, nevertheless, exist in these roots, consequently, I conclude that he exhibited this preparation merely as an argument; as if he had said, you must grant me that there are vessels to imbibe the juices of the earth which afterwards become the sap or nutritive fluid of the plant; and I am convinced there are similar vessels to perform a similar function in all parts of animal bodies. After having been teased and perplexed by sceptics, he could only reply from analogy, and therefore, I suppose he put up this root, which though it shews little to the eye of sense, he thought might demonstrate much to the eye of reason.

Mr. Hunter, however, has exhibited in this department of his Museum, many specimens of what may be considered as the trunks of these undemonstrably minute vessels. He also injected them in whales, to show their analogy to those found in other mammalia, and that they were very minute vessels, even in such monstrous animals.

I was acquainted with Mr. Hunter at a period of his life when he must have greatly interested any one, who duly appreciated the results of his talents and labours, or who had any sympathy for the highly susceptible mind of genius, rendered still more so by excess of exertion, and the perturbed feelings incident to bodily disease. He seemed to me conscious of his own desert, of the insufficiency and uncertainty of his acquirements, and of his own inability readily to communicate what he knew and thought. He felt irritated by the opposition he had met with in establishing his opinions; and still more by finding, when he had surmounted this difficulty, that those opinions were, by the malice of mankind, ascribed to others. All which, I think, may be fairly inferred from a single sentence he one day addressed to me: "I know, I know," said he, "I am but a pigmy in knowledge; yet I feel as a giant, when compared with these men." It interested me to find

amongst the manuscripts to which I so frequently refer, a long extract from a French author, who was said to have taught the same opinions relative to absorption before him. Mr. Hunter has made his own commentary upon several of the passages, and as it seemed to him that by nothing short of a new construction of words and sentences could any resemblance of opinions be made to appear, he was induced to add, "This reminds me of a dispute that took place between a zealous convert to the Newtonian philosophy, and a Hutchinsonian, in which the latter having, by garbling and transposing certain passages from the Scriptures, seemingly made good a very absurd proposition; the latter retorted, Yea but it is also written, Judas went out and hanged himself; moreover it is added, Go thou and do likewise." Those who were acquainted with Mr. Hunter, know full well that he had a great deal of drollery in his composition.

No one can read Mr. Hunter's works without being convinced that he was a man of perfect candour and scrupulous veracity. Such a character must be its best biographer, and I am much gratified that he has, to a certain extent, published his own account of his deeds and designs. The first editor of the European Magazine, printed in 1782, was well acquainted with Doctor Hunter and his brother, and being desirous of giving, in that work, an account of the distinguished schools of science both at home and abroad, he began with the lectures of these brothers. That the account and anecdotes of Mr. Hunter are genuine, the editor has given me the most positive assurance, adding, "I received the materials from his own hand." Here John Hunter speaks for himself, but is made to tell his story with simplicity and effect, by the friendly aid of the then editor* of the magazine. That Mr. Hunter acquired the best physiological knowledge of the time from his brother's lectures cannot be doubted, but he was not satisfied without examining facts for himself and forming his own opinions. Therefore we find Mr. Hunter asserting that all this kind of knowledge had been the result of his own personal observations and reflections; he does not say that his opinions are new, but only that they are new to

* Mr. Perry, now editor of the Morning Chronicle, who superintended the publication of the European Magazine at its commencement, though but for a very short time. I have annexed his account of Mr. Hunter, to this publication, because it is brief; and it must, I think, be interesting to all to be informed what were the intentions and objects of Mr. Hunter, in his lectures and labours.

him. It was the malicious transfer of his facts and opinions to others, which, as I believe, first induced him to read, or rather to get books read to him; and we find him in every instance candidly acknowledging the claims and merits of his predecessors, whenever he discovered them.

ON THE ORGANS FOR THE DISTRIBUTION OF NOURISHMENT.

It has been already remarked, that in some minute and even vivacious animals, no organization is discernible, and therefore nothing can be known in them, respecting the subject now under consideration.

There seems, however, to be a very exact coincidence of opinion between Hunter and Cuvier, as to the structure of the fresh-water polypes, (as they are called,) the hydræ of Linnæus. Professor Cuvier believes, that polypes are formed of a pulpy substance, having pores that imbibe nourishment, which becomes arranged so as to constitute their bodies, and to produce their shoots, or offspring. Mr. Hunter says, "I have an idea that some animals absorb their nourishment similar to a sponge, and dispose of it immediately to their own increase."

To me, however, who confide more in the eye of reason, than in that of sense, and would rather form opinions from analogy, than from the imperfect evidence of sight, it seems too hasty an inference to conclude, that in the minute animals, there are no vessels nor other organization because we cannot see them; or that polypes are actually devoid of vessels, and merely of the structure described, because we can discern no other. Were it, however, really so, such facts would then only show with how little, and with what various organization life could accomplish its principal functions of assimilation, formation, and multiplication. Who has seen the multitudinous, distributive, and absorbing vessels, and all the other organization which doubtless exist in the vitreous humour of the eye, than which no glass ever appeared more transparent or more seemingly inorganic? How strange is it, that anatomists, above all others of the members of the community of science, should hesitate to admit the existence of what they cannot discern, since they, more than all the rest, have such constant assurance of the imperfection and fallibility of sight?

Amongst the zoophytes, Professor Cuvier says, that in medusæ and similar animals, vessels arise from their digestive cavities, which do not return, but exhaust their contents in deposition, effusion, and transpiration. It is ascertained that Mr. Hunter injected the vessels of medusæ from the digestive cavity, in some of the specimens preserved in the Museum in the year 1779, and these vessels appear beautifully distributed throughout the substance of the animal, frequently communicating like the threads of network. In animals thus nourished, in which there is no circulation, there can be no distinct respiratory organs; neither do they want them, for their blood or nutritive fluid is every where exposed to circumambient air.

In the animals included in the class of vermes, according to the arrangement in Professor Cuvier's lectures, many of which have red blood, and therefore its motion is more apparent, we meet with the first generally acknowledged instance of circulation. They have a dorsal vessel running the whole length of the animal, which is large in the middle, and becomes gradually smaller towards either end. Sometimes there are dilatations in it, causing it to appear as if varicose; and there are lateral dilatations which may be considered as hearts; or the whole tube may be regarded as the heart of the animal. This vessel is displayed in the Museum in the common earth-worm. The animals of this class have in general large vessels on each side lying in contact with the air-vesicles or lungs, which are considered as the venous trunks returning the blood to the dorsal vessel. They are exhibited in the Museum injected in the leech. Mr. Hunter says, "they are the venæ cavæ, or great returning veins of the body, and also the pulmonary veins; for in them the blood is aerated." His mode of expressing this two-fold office, is by saying, "such veins are both corporeal and pulmonary."

It must be exceedingly difficult to inject the vessels of vermes, so as to display their communications; nor do I find that Mr. Hunter has made any preparations to demonstrate the various branches of the dorsal vessel or its returning veins. What is asserted in general with respect to this subject, has, I believe, been chiefly discovered by observations made with the microscope on those animals when living. Mr. Hunter, in expressing his observations on the manner in which the body is supplied from the dorsal vessel in these animals, says, they have not one aorta or distributive trunk, but many aortæ. Professor Cuvier, in his account of the organs for the distribu-

tion of nourishment in the class of vermes, principally appeals to the evidence of what may be seen in the arenicola, or lumbricus marinus of Linnæus. Sir Everard Home, being particularly desirous of examining the circulation in this animal, on account of its having external branchiæ, sent for Mr. Clift to the coast of Sussex for this purpose; and their conjoint observations on the vessels and circulation in this and other vermes, are printed in the Philosophical Transactions for 1816.

That Mr. Hunter was as well acquainted with the circulation in animals of the worm kind, as any of his successors, is, I think, evident from his writings. He says, "they have the most simple kind of circulation, which is, when the blood, propelled by the heart, becomes aerated in its circulating passage." He also says, the motion of the blood is a kind of undulation; which phrase, though not sufficiently explanatory, must, I think, principally have been suggested by what is observable in animals of this class. I am, however, aware that the motion of the blood in the vessels of the chicken and its appendages before they are conjoined, and a circulatory motion consequently established, might have suggested the same expression. In worms, we see the dorsal vessel pretty suddenly filling, till it is distended with blood; it then contracts, urging on its contents, till it is empty, when, after a time, it is again replenished. Thus wave follows wave, but the cause of this interrupted, or seeming undulatory motion, has not perhaps been fully explained. Analogy would induce us to consider the systole and diastole of the dorsal vessel, as similar to what is observed in the heart of the higher classes of animals, and that the tardiness of the circulation is the cause of this apparently undulatory motion.

The spiracula or tracheæ in the sides of worms terminate in vesicles, which are considered as their lungs. They are numerous and distinct, situated all along the sides of the animal in contact with the lateral blood-vessels. These air-vesicles, or lungs of worms, are exhibited by beautiful preparations in the Hunterian Collection; and in some instances, vesicles are also shown in the back of the animal.

It is scarcely credible with what patience Mr. Hunter examined the structure of the lower kinds of animals. He contrived spectacles with glasses of different degrees of magnifying power, so that by a slight alteration of the position of his head, he could look through the one or the other. Mr. Clift tells me, he would stand for hours motionless as a statue,

except that with a pair of forceps in either hand he was picking asunder the connecting fibres of the vessels of parts, till he had unravelled the whole structure. Thus did he make the preparations of the amphinome flava, and aphrodita aculeata, which you will find in the Museum. In the former, he thought he had distinctly traced numerous minute vessels, which he considered as absorbents, extending from the bowels, laterally, nearly the whole length of the animal, and terminating in small vesicles, which lie in contact with the respiratory organs. In the former he found numerous minute tubes continued from the intestines, which are of considerable length, and which, after ramifying towards their extremities, terminate in little oval cells or cæca, which are lodged in the sides of the animal, in contact with the pulmonary vesicles.

There are different preparations of these parts in the Museum, and when the intestines happen to contain a whitish substance, it is also seen in the tubes and cells; when the bowels contain a blackish matter, it is likewise found in these appendages. What Mr. Hunter thought respecting this subject is not known. Such tubes may be considered either as terminating in the intestines, or proceeding from them.

In order to attempt the investigation of this subject, I requested Mr. Clift to inject the alimentary canal of the aphrodita with fine injection, and it passed into these numerous tubes, and cæca, all of which are fully distended; but we cannot observe that the injection has gone further. I show you this preparation, and you see these cæca in their natural situation, from which they are removed in the other specimens. I beg leave also to mention, that being desirous to ascertain how far the distributive vessels of the lower kinds of animals admitted of being injected from their digestive cavities, as is the case in medusæ, and also to observe, whether any transudation took place through their sides, I requested Mr. Clift to inflate and inject with subtile liquors, the digestive organs in echini, insects, and vermes; and as far as his enquiries have yet extended, he finds the canal similar to that of the higher classes, neither air, nor injection impelled, escapes from it, either through its sides, or by proceeding into vessels.

According to the present arrangement of the subjects of Comparative Anatomy, insects form the next class to zoophytes, and worms succeed to insects. I have told you what Mr. Hunter knew and thought about the structure and

functions of worms; first, because it is probable that analogy, as well as his own observations, which may indeed have been biassed by analogy, led him to believe, that the circulating and respiratory organs of insects were similar to those of vermes. Like Swammerdam and others, he considered the dorsal vessel as the heart of the insect, and it is exposed in his Museum in the bee, the preparation being marked, the heart of the bee. We find bees, beetles, and silk-worms injected in the Hunterian Collection, but how, no one can tell. I should not have supposed that Mr. Hunter would have injected from the spiracula or orifices of the tracheæ, with which he was well acquainted. Yet the injection, wherever impelled, might have been effused, or have got into and pervaded the air-vessels, which is supposed to be the case, by those who put faith in the modern opinions respecting the anatomy of insects. Mr. Hunter also believed, that the pulmonary organs of insects were similar to those of the vermes, and he says, they not only serve to ventilate the blood, but to give levity to the body of the animal in those insects which fly. He says, the vesicles are larger in beetles, whose bodies are heavy, than in the lighter kinds of flying insects. He further mentions, that the vesicles or lungs of the flying insects are different from those of others; as they extend throughout the whole length of the body.

You probably know, Gentlemen, that the present belief with respect to the nutrition of insects is, that the digestive aliment absorbed from the bowels passes on by the same tubes to all parts of the body, and that tracheæ, or air-vessels, are equally distributed, so as to produce a general and complete aeration of the nutritive fluid. It is further believed that the glands of insects are merely composed of contorted tubes. Yet the crustaceous animals, (formerly accounted insects,) spiders, some phalangia, and scorpions, are admitted to be of a different structure, and to possess both circulating organs and lungs like those of vermes. Lyonnet, Cuvier, and others, assert that the dorsal vessel found in insects gives off no branches, and that no motion of fluids can be perceived in them, even by the aid of the microscope. Professor Cuvier says, 'tout le corps est nourri par une fluide stagnant.' Yet even vessels can produce a free and forcible motion of their contents, as is evident in vegetables, and in the absorbents of the higher classes of animals. If there were no current in the fluids of insects, how could liquors run so freely as they are known to do from the contorted tubes that form

their glands? Professor Cuvier is disposed to consider the irritability of animals as greatly dependent on the aeration of the blood; and ascribes the vivacity and power of insects to its great exposure to air. Yet this opinion cannot, I think, be maintained as a general inference in physiology: for what animals are more agile, powerful, and indefatigable than fish, and yet we have reason to believe their blood is very imperfectly aerated?

I have done, as I am convinced Mr. Hunter would have done, candidly acknowledged his opinions, and readily admit them to be erroneous, if they are shown to be so. I cannot, however, but imagine how he would have rubbed his head, and thought, and wrought, till he had satisfied his mind repecting this subject; when, if he became convinced that the modern opinions were right, we may readily suppose what a train of reflections would have succeeded. How curious must it appear that these very vivacious and powerful little creatures, which also possess such a complex apparatus of muscles, should be nourished in a manner not unlike that of vegetables; that the food, when digested, should be absorbed from their bowels, and that the absorbing system should become the distributive one, without the aid of any pumping engines or hearts to urge on the current.

To Mr. Hunter, however, who believed life to be a principle independent on structure, which could exercise its functions with diversity of means, none of the circumstances I have alluded to could excite wonder. He would labour, as he always had done, to ascertain facts, and the additional facts would, on this, as on other occasions, only serve to confirm his already well established theory.

In the present class of animals denominated crustacea, Mr. Hunter examined the lobster with particular attention, and has left most beautiful drawings, as well as preparations, demonstrating its anatomy in general. He was probably induced to make this attentive examination from considering it as a large specimen of the insect kind, in which the structure common to the whole tribe might be more readily discovered and displayed. With respect to its circulating and pulmonary organs he says, "The heart which is unilocular, propels the blood throughout the body, which fluid receives purification in its passage; and that the blood returns, both from the body and from the lungs to the heart, which it throws out, in a mixed state, equally to the body and lungs." Every one is acquainted with the pulmonary apparatus of lob-

sters and crabs, that pith-like production that is drawn out of their bodies with their legs when they are torn off.

Ascending to the newly established class of molusca, I find Mr. Hunter acquainted with all the facts which have warranted later Comparative Anatomists in making this distinction; so that he might himself have formed the arrangement, had his mind been directed to the subject of classification. Speaking of the situation of the heart in the multiform animals now included in this class, he says, it is very various, and seems chiefly to depend on that of the lungs: also that it is differently situated, even in animals of the same kind, as in the snail and slug. With respect to its structure, he says, in the snail, and in many of the inhabitants of shells, it is composed of an auricle and ventricle, whilst in others it has two auricles and one ventricle. He thinks that in the single heart with two auricles, it is formed, as it is in reptiles, to receive the blood both purified and unpurified, and to throw it out in a mixed state. He distinguishes in this class of animals between the corporeal and pulmonary hearts, observing, that the snail has a heart for the former circulation and not for the latter. He particularly examined, and was thoroughly acquainted with the circulating and respiratory organs of the cuttle-fish, which are displayed with his usual perspicuity and accuracy, by preparations in the Museum, and also by beautiful drawings, two of which have been lately published in the Philosophical Transactions for 1816, by Sir Everard Home.

As no one can doubt Mr. Hunter's knowledge of the circulation in fish and reptiles, I shall say nothing on this subject, except remarking, on account of the physiological inference the fact admits of, that the fish has only a pulmonary heart. It is composed of an auricle and ventricle, the former receives the blood returned from all parts of the body, and the latter propels it through the gills, where, having undergone the change produced by respiration, it returns by vessels which, ending in a single trunk, form the great distributive vessel or aorta of the animal; to which no heart is connected; so that the blood receives no additional impulse besides that derived from the action of its containing vessels. Therefore, these extremely agile, powerful, indefatigable, and vivacious creatures are supported by a languid circulation and trivial respiratory process: a fact which warrants the conclusion, that the powers of life can be exerted according to their allotted manner, without that quick supply of materials, or

great degree of change produced in the circulating fluids by respiration, both of which many physiologists have been accustomed to consider essential to the production and maintenance of such high degrees of vital action.

In order to explain the varieties of hearts met with in different animals, Mr. Hunter seems to have sought for some generic term, simply expressing the number of cavities found in them, without any reference to the connections or offices of those cavities; and his friends must have supplied him with the terms which he employs, Monocoilia, Dicoilia, Tricoilia, and Tetracoilia. He considers the heart as a pump, which forcibly impels the fluid it contains into the vessels. Where there are two cavities, he says, one is an auricle, and the other a ventricle. The auricle is a cistern or reservoir, from which the contents are suddenly forced into the more efficient cavity or pump. Sometimes there is a heart or pump to the pulmonary circulation, and none to the corporeal; and sometimes there is one for the latter and not for the former, and sometimes one for each. Even in the quadruped and bird, in which the heart appears most complex, he says, it is equally simple, there is a heart for either circulation, but these are united into one organ.

In advocating Mr. Hunter's reputation as a general physiologist, I ought not to omit to commemorate his labours in examining the circulation of the blood in the higher classes of animals. Doubtless the phænomena of the constant supply of blood to every part, and the building up and repairing the structure of the body, must have appeared to him so curious and wonderful, as to induce him to admit nothing upon the authority of others, and to examine every fact for himself.

Though I now engage in a subject which more especially I have a right to discuss, as it relates to human anatomy, yet I must not weary you by detailing facts familiarly known, or proving propositions which are generally admitted. Were I also to advert to the doctrines of others, I should have to collate asserted facts and opinions, irreconcileable with one another, and to engage in controversial discussion; yet why should I bandy about the ball of controversy, wasting both my own labour and your time, if I know I must let it fall at the conclusion, just where I took it up at the beginning? It seems best for a lecturer simply to say what he thinks, and

why he thinks it, because it is the only way in which he can feel, and consequently create an interest in that which he delivers. I shall therefore merely tell you what I have been taught by Mr. Hunter to think with respect to the principal parts of the subject of the distribution of nourishment in the higher classes of animals.

First, then, I find Mr. Hunter examining the structure of the arteries or tubes by which the blood appears to be carried to every part of the body. He is neither clear nor confident in his description of them; and yet I know not that any one has described them better. Internally they are membranous tubes, which is a common character of all sorts of vessels, the polished surface of the membrane admitting their fluid contents to pass along with the greatest facility. He knew that exterior to this, and not far from it, there was some substance, thin, but particularly strong and unyielding, which caused the vessel to have a regular circular form when distended. He found that when the trunk of the distributive vessels, the aorta, was injected with a force equal to ninety pounds, this part suddenly cracked, and the external elastic matter of the vessel readily yielding, it became distended by the effused injection, into a bulky, but irregular, form.

Mr. Hunter thought that the great quantity of elastic matter which surrounds large arteries was well calculated to prevent that injury to the vessels, which the powerful propulsion of blood by the heart might otherwise occasion. Nay, he observed that the quantity of elastic matter was greatest where it appeared most wanted, that it was greater on the convex part of the arch of the aorta than on the concave. He further observed, that certain arteries which are occasionally much elongated, have a far greater share of elasticity in their longitudinal direction than others. The quantity of elastic matter surrounding arteries also gradually diminishes as these tubes recede from the heart, and the impulse of that organ diminishes; which well known fact corroborates the opinions I have just mentioned. The elasticity of the large arteries may also lighten the labour of the heart by the kind of suction it may sometimes occasion.

Mr. Hunter knew, that in cases of hæmorrhage, the arteries would gradually contract upon their diminished contents, to a much smaller calibre than common; and he measured their areas in the contracted state in which they were found in a horse that had been bled to death. He then distended them, so as to destroy the effect of this vital contraction; and

having suffered them to regain that calibre which their elastic property naturally determines, he again measured their areas, and found that the aorta had contracted, in the first instance, to more than one-tenth of its natural diameter, the iliac to one-sixth, and the crural to one-third. He also observed, that arteries corresponding to the radial of the human subject, and others of the same size, were closed. I also think it evident, in the common operations of surgery, that arteries of no inconsiderable magnitude, which have bled vehemently, and in a large stream immediately after their division, very speedily cease to bleed, and remain with their orifices so closed, that they are scarcely discernible. I have seen the radial and ulnar arteries of the human subject, appear like impervious chords. This happened, indeed, in young patients. Yet, Mr. Hunter never attempted to demonstrate muscular fibres in arteries; he says there is a reddish substance surrounding the tube near the internal coats, which he believed to be the structure possessing irritability. Specimens of arteries thus contracted, and contrasted with others of the same size, but of their natural dimensions, are exhibited in the Museum. Mr. Hunter must have been acquainted, from his brother's lectures, with the inconclusive experiments of Haller, relative to the irritability of different parts of the body. He adopted another and a better mode of determining, whether parts possessed a power of vital contraction. Observing that this power in muscles produced contraction after the ordinary functions of life had ceased, he tried whether, and for what length of time, parts could contract in this manner. Thus did he satisfy himself, that the arteries of the funis umbilicalis had vital energies remaining in them sixty hours after its detachment.

Mr. Hunter's notions of life were peculiar. He thought that it was an active principle, which, by operating in various modes and degrees, produced the different phænomena by which its existence is characterized. He knew that parts, in which no muscular structure was evident, were nevertheless irritable, and that the modes of contraction and relaxation of muscular parts were various. He seems by no means satisfied, that all the phænomena of muscular relaxation can be accounted for, on the supposition of the abatement or cessation of an active power. Without, therefore, pretending to determine the modes of action of the sanguiferous tubes, seeing that they have a power of vital contraction upon the diminishing quantity of their contents, knowing that vessels

alone are capable of producing a quick and forcible current of their contained fluids, as is evident in the ascent of sap of vegetables, and still more so in the acceleration of the current of the fluids contained in the absorbing vessels of animals, as they approach to the trunk of the system, we seem warranted in concluding, as Mr. Hunter has done, that the different degrees of power allotted to different parts of the arterial system, is given to them for the purpose of aiding in carrying on the circulation.

When the blood is projected by that powerful engine, the heart, into the large arteries, little energy on their part is requisite to urge on the rapid current; but in proportion as the heart's influence diminishes, power is allotted to the vessels to aid in its propulsion. There are some modern physiologists, and those of high repute, who consider the heart, by its actions alone, as fully adequate to maintain the circulation, and consequently discredit the irritability of arteries, except of those which are called capillaries. But where, I would ask, am I to suppose that these capillaries begin? I cannot observe the sudden and deep blush of shame, or extreme paleness of terror, without being convinced that arteries of no inconsiderable size possess vital activity; we cannot believe that the heart's influence can be partially exerted, determining the blood into one set of vessels in preference to another. How then can we account for the vehement hæmorrhages which take place from inflamed arteries, unless we admit vessels of magnitude to possess vital activity? Do we not know that an hæmorrhagic action is a natural phænomenon in some parts of the body, that arteries occasionally pour the blood so impetuously into the corpus cavernosum and spongiosum, as suddenly and forcibly to distend them?

I can scarcely believe that if an anatomist were injecting the principal artery of the dura mater, and had burst its trunk, he could, with the utmost efforts, expel so large a quantity of injection, and compress the brain to the degree that we sometimes find it to be by blood, when that vessel is torn and irritated by injury. Yet the same vessel does not bleed when exposed. Can we account for such facts from the actions of the heart alone? How also, I would ask, am I to account for the vehement throbbing of all the large arteries of the arm, even as far as the axilla, which may be sometimes observed, when an abscess forms at the end of one of the fingers? How am I to account for the distinct pulsation we often perceive in the carotid, or abdominal aorta,

unless some vital activity be admitted to exist even in the larger vessels? We may indeed, in some instances, account for the phænomena which we observe, by supposing constriction to have occurred in the capillaries of the large pulsating trunk; but this supposition appears to me very inadequate to explain the whole of the phænomena of such occurrences.

Our physiological theories should be adequate to account for all the vital phænomena, both in health and disorder, or they never can be maintained as good theories.

Mr. Hunter enquired if the area of arteries increased as they receded from the heart, and for this purpose examined the trunk of the common carotid, which runs to some distance without giving off any branch of importance. He found it largest at the end furthest from the heart. He was convinced that the conjoined areæ of all the minute arteries must greatly exceed that of the aorta, where it emerges from the heart, and therefore that every portion of blood projected by the heart was moving into an increasing space.

Mr. Hunter, who believed that, in living beings nothing was constructed or done in vain, could never have observed the very curious contortions of some arteries, which he has taken much pains to display in his Museum, nor those of the great vessels as they enter the skull, without supposing that some purpose was effected by them. Neither could he contemplate the coalition of currents of blood moving in contrary directions, which is produced by the arteries communicating and conjoining with one another, without admitting that it must tend to retard the velocity of the motion of such opposing currents. Mr. Hunter therefore joined in the physiological belief, that all the circumstances we observe in the distribution and ramification of arteries, are calculated to produce a rapid current of the blood through the larger vessels, in order that it may arrive unchanged at the part for the supply of which it is designed; and that other circumstances there occurring, are intended to retard its motion, so that it may be modified and rendered subservient to the purposes of secretion and nutrition.

Now you know, Gentlemen, that some physiologists suppose the velocity of the current of blood to be equal in all sets of vessels. With respect to this subject, I will merely refer you to an experiment of Hale's, in his Hæmastatics. Having estimated the probable force of the heart, he put a tube into the aorta of a dead dog, and kept it filled with water to a height which would give an equal propulsion to the supposed

power of the heart. Under these circumstances, having opened the abdomen, he cut along the tube of the intestines, at that part most remote from the mesentery, and observed the water running tardily from the orifices of the divided arteries. He then divided the mesentery at the edge next the intestine, where the vessels being larger, the water ran rapidly from them; and when he opened a vessel of considerable size, it gushed from it with the same velocity and force that blood issues from the same sized vessel when divided in a living animal. I refer you to this experiment, because it seems far better calculated to display the effects likely to result from the circumstances we observe in the distribution and ramification of arteries, than any we may make with tubes of our own construction.

Mr. Hunter was convinced that arteries terminate in veins; for if we inject the former with any subtile fluid, it quickly and freely returns by the latter. I know not, however, whether the magnitude of some of the communicating tubes was ascertained till of late years. I have in my possession a hand which was injeted with wax about thirty years ago, and the wax passed freely from the arteries into the veins, so as to afford a beautiful exhibition of the network of small veins, which proceed to terminate in the larger trunks, in a manner which I had never before seen demonstrated, except by injections of quicksilver. In dissecting this hand, the vessels which transmitted the injection from the arteries into the veins were apparent. Some artifice is, however, necessary to our success, in making these preparations. We should suffer a part to become slightly putrid, before we inject its vessels, which produces a yielding state of them, favourable to the transit of the injection. Yet there are arteries which terminate in veins, so small, as not, in their natural and healthy state, to transmit even coloured blood, so that there is, in fact, something similar to a speculation of Boerhaave's, something like a descending series of vessels. It also evidently appears, that the great mass of the blood is freely transmitted from the arteries into the veins, so that it rapidly and regularly circulates; and we therefore conclude, that but a small portion passes into the finer vessels, there to undergo those modifications which fit it for the production of the secretions, and the various materials for the nutriment of the body.

The veins freely communicate with one another, and joining together, they form tubes of apparently larger dimensions.

but of less actual calibre than the branches by which they were formed; so that in these vessels the blood is obliged to pass through converging channels, which eventually end in the two venæ cavæ, the conjoined areæ of which are inconsiderable when compared with the space the blood has occupied in all the minute veins of the body. Consequently, if the heart pumps out an ounce and a half of blood at each action into the arteries, and the same quantity is returned, in the same time, to that organ by the veins, it must be urged in the like interval from the small arteries into the veins, and run with accelerated velocity as it approximates to the heart. Of this circumstance we may, I think, be convinced by ocular demonstration, even in the ordinary practice of our profession. There is much more space in the veins than in the arteries, which prevents any trivial obstruction in the former channels from impeding the transmission of the blood into them through the latter. The superficial veins which meander on the surface of the body are beset with numerous valves, or flood-gates, which prevent the blood from moving in a retrograde course, and oblige it to go onwards towards the heart. The blood sometimes returns to the heart, chiefly by the deep-seated veins which accompany corresponding contiguous arteries, and at others more abundantly through those on the surface. Mr. Hunter believed that veins possessed vital activity but it must be of the kind allotted to the muscles of tardigrade animals, and such as various parts of our bodies are also endowed with. Indeed the large veins near the heart are said to evince an irritability of the more common kind. The nature of the irritability of veins may enable them to adapt their calibre to their contents. Mr. Hunter argues that, as the vena portæ in the liver performs the function of an artery, it probably is irritable. We know that it fails to secrete, or secretes with profusion; that sometimes it prepares healthy, and at others faulty, bile, which variation of function can scarcely be supposed to take place in a perfectly passive vessel.

The blood returning from all parts of the body is, in the higher classes of animals, propelled from the right side of the heart through the lungs. To observe the circumstances resulting from the conjoined actions of the heart and respiration, Mr. Hunter contrived a pair of bellows by which he could maintain the latter process in an artificial manner, and thus he was enabled to observe how greatly the heart's action depends on its continuance. He says, "the nearest depend-

ence of the heart is upon the lungs, for a stoppage of respiration produces a stoppage of circulation; and a renewal of the former is attended with a renewal of the latter. Thus, in my experiments with artificial breathing, the heart soon ceased to act, whenever I left off acting with my bellows; and upon the renewal of artificial breathing, it in a very short time renewed its action, first by slow degrees, but becoming quicker and quicker till it came to its full action." Mr. Hunter displays the subject of the structure and uses of the lungs, according to our present notions. He says, "that as the function of the lungs becomes augmented in animals, so are their cells minute, and the pulmonary vessels subdivided, by which means the surface of the air and the blood exposed to reciprocal influence is proportionately increased. Carbon is evidently thrown off, and a change produced, of the precise nature of which we are ignorant, but which is rendered evident to our senses by a change of colour; for the purple current acquires a scarlet hue, or, as it is commonly expressed, the venous blood becomes arterious. Chemists have considered the change as contributory to the production of animal heat; which opinion may indeed be true, though the manner in which it produces such an effect, has not as yet been explained." Mr. Hunter, who believed that life had the power of regulating temperature, independently of respiration, says nothing of that process as directly contributing to such an effect. He says "breathing seems to render life to the blood; and the blood conveys it to every part of the body." Yet he believes the blood derives vitality also from the food. The experiments of Mr. Brodie, which I have mentioned in the first lecture of this year, seem satisfactorily to show, that the transitions of colour, which are produced in the blood by respiration and circulation, are not of themselves alone adequate to occasion a change of temperature. I am at a loss to know what chemists now think respecting heat, whether they consider it to be a distinct species of matter, or mere motion and vibration. Among the curious revolutions which this age has produced, those of chemical opinions have a fair claim to distinction. To show which, I may mention, that a lady * on her first marriage, was wedded to that scientific champion who finally overthrew the dominion of phlogiston, and established in its stead the empire of caloric; and after his decease, on her second nuptials, was united to the

* Madame Lavoisier, who afterwards married Count Rumford.

man, who vainly supposed he had subverted the rule of caloric, and restored the antient but long banished dynasty of motion and vibration. In this state of perplexity, I cannot advance with prudence or probable security one step farther than Mr. Hunter has led me. I must believe respiration to be essential to life, and that life has the power, by its actions, of maintaining and regulating temperature.

Mr. Hunter suggested that the blood ought, for numerous reasons, to be considered as a living fluid, and adds, "that the blood has life, is an opinion I have started for above thirty years, (which must have been in the year 1760,) and have taught it, for nearly twenty of that time, in my lectures." I quote this passage merely to show how early he had acquired those notions of life, which I consider as the primary stimulus of his meritorious and highly useful exertions. He wonders that this opinion had not been more deeply impressed on the minds of medical enquirers, because the blood undergoes evident changes from variations in the state of the health, and the actions of the vessels. Life is generally attributed to solids only, yet these are formed from the blood, which could not give them what it did not possess. He says, that in the years 1755—6, when making drawings of the changes which took place in the incubated egg, he was particularly struck with the well known fact, that the yolk and white, which we cannot suppose to be organized, did not putrify; and this led him to believe that fluid and semi-fluid substances might have a principle of life diffused through them.

Every one must be convinced that the power of the heart is very considerable, even from observing the thickness and compactness of its fleshy structure. Dr. Hales estimated its force as equal to a little more than 70lbs. That it could not act with the enormous force which some have attributed to it, Mr. Hunter inferred from finding that a force of 90lbs. burst the inelastic part of the aorta. Mr. Hunter believed that the forcible projection of an additional quantity of blood from the heart into the arteries, produced a sudden motion in the whole column contained in these tubes, and occasioned their almost simultaneous pulsation in every part. He could not doubt that if they were contracted, they would be distended by the impulse of additional fluid; yet with reference to this point, he observes, that upon laying bare an artery, no distention of the tube is apparent; and that the distention seems to take place in proportion as it is covered or compressed.

Such, then, is the view Mr. Hunter has exhibited of the circulation in the higher classes of animals; and on contemplating it, we perceive how every part of the body may duly receive its allotted portion of nourishment and life, as well as how each part may receive less or more than its ordinary quantity, in consequence of the vital actions of its own vessels.

I do not perceive, however, that his representation of the circulation differs materially from that of the best physiologists who preceded him. But he has the merit of examining every point for himself, and under all the varieties of circumstances; as well as of ascertaining what before appeared obscure and uncertain. This theory of the circulation has been assaulted, and yet, as far as I can perceive, without being either injured or invalidated. Therefore I am disposed to maintain it, for the same reasons that I am his theory of life, because both are probable, cautiously and philosophically deduced, and adequate to explain all the phænomena of health, disorder, and disease; which I think cannot be said of any other theory relative to either of these subjects.

LECTURE VI.

ON SECRETION AND NUTRITION.

AT the conclusion of the former lecture, I exhibited a kind of sketch of Mr. Hunter's facts and opinions relative to the circulation of the blood, and the change wrought in that fluid, by respiration. I have now to enquire wherefore does the blood circulate? Is it not for the nourishment of the body, and the preparation of various fluids and substances subservient to the animal economy? We believe, for reasons which I need not detail on the present occasion, these objects to be effected by means of minute vessels, which go off from the extreme arteries, and which sometimes terminate by open orifices, effusing or depositing their contents; whilst sometimes they lead on to other channels, which collect and convey the fluids they receive, to certain reservoirs or surfaces. These vessels which prepare and separate something from the circulating fluids are called the secerning vessels. It is curious to observe Mr. Hunter's expressions with regard to these agents. "I would not," says he, "call them arteries;

they are workers, they are the labourers." He would not consider them as concerned in the circulation of the blood, they are the chemists and the architects of the body. That such vessels could separate from the blood something that was formally present in that fluid, might be easily credited. But how they could prepare that extreme diversity of fluids and substances which they are known to do, formed a problem that was never solved till the time of Hunter. He thought that the vital principle of the vessel, acting on that of its fluid contents, produced these chemical changes. He thought that there was a correspondence or concert of affection and action between them, a harmony as he calls it. Thus did he attempt to explain how a morbid state of fluids could induce an unhealthy action of vessels, and how the latter could reciprocally occasion the former. Was he not, indeed, a strong and clear-sighted man, who could see so far through the obscurity in which these subjects were involved, in his time? But the sun of science has since shone on them, and we now see distinctly the probability and rationality of his theory. Sir H. Davy's experiments prove that they are electrical actions, by which all combinations and decompositions of matter are occasioned, and that what is called electricity pervades every thing whether solid or fluid. In speaking of digestion, it has been already shown, that actions productive of secretion are regulated by the general powers of life, by the energies of the nervous system. Every one now seems convinced, by direct experiments, that vessels so modify their contents, that the liquids and substances which the absorbents take up, become lymph, a fluid resembling blood, in their transit through those vessels; and that the chyle imbibed from the bowels is undergoing continual modifications as it proceeds through these channels to the sanguiferous system. Yet, as I have mentioned in my former lectures, the most direct proof of the truth of Mr. Hunter's opinions respecting secretion was given by himself, and at a time when these subjects were involved in darkness, by showing the effects resulting from the application of morbific animal poisons.

From observation and analogy, Mr. Hunter was induced to believe, that the coagulation of the blood was an effect resulting from the vital principle, and similar to that contraction which takes place in muscles, after the cessation of the ordinary functions of life. He mentions that in animals killed by lightning, or large charges of electricity, in those which have been hunted to death, or destroyed by violent blows on

the stomach, he had observed that the blood did not coagulate, neither did the muscles become rigid.

That the powers of life inhere in any distinct substance which makes no part of the visible structure of the body, may indeed, in every instance, be doubted, but if this be conceded, the consideration of the vital phænomena oblige us to admit that there is a principle of life pervading the blood, so that Mr. Hunter's opinions on that subject cannot well be disputed, and appear to be fully established by Sir H. Davy's discoveries. Yet his opinion of the coagulation of the blood being occasioned by its vitality has neither been proved by himself, nor disproved by others. It is a detached opinion making no part of the general discussion relative to the vitality of the blood; and therefore it is strange that so much has been said and written about it. Those who do not understand, or who dislike Mr. Hunter's opinions, have in general furiously assailed this detached and seemingly unsupported one, yet without in the least injuring or altering it; whilst others, who are advocates for Mr. Hunter's theories, have hurried to its defence, as if all would be lost should this single opinion be destroyed. Thus both parties seem to have been led away from the main subject. How seldom do we consider propositions with the deliberate exercise of those powers of observation and reason with which we are endowed! We are partial to our opinions, and consequently prejudiced against those of others. In argument we strive for victory rather than seek for truth. That self-conceit which leads us chiefly to attend to our own opinions and feelings, and to disregard those of others, renders us indocile, unfits us for patient and impartial consideration, and is a great obstacle to the progress of science, as well as to human happiness in general.

Mr. Hunter believed that the secerning arteries, having prepared the various kinds of nutritive materials for building and repairing the different structures of the body, deposited the atoms from their open orifices with such regularity, as in a great degree to achieve this surprizing purpose. He however believed that the life of the parts assisted in producing their arrangement. The occurrences met with in disease afford the strongest confirmation of these opinions; every fibre being subject to sudden and unnatural increase, mutation, or removal.

In consequence of the opinion that each particle was deposited by an appropriate vessel, he was induced to add that

every part of the body may in this sense be said to be equally vascular; what is meant by increased vascularity depending upon the greater size or number of the vessels, which transmit the blood, allowing them to be more distended with red blood, or our coloured injections. Further, he observes that an increase of apparent vascularity may be the result of vessels passing through parts to terminate elsewhere.

Now, though Mr. Hunter attributed so much to the agency of vessels, he believed that life, in various instances, formed these active tubes. His opinions might indeed be biassed by what he had observed in the cicatricula of the egg, but he thought that vessels might be formed in effused gelatinous matter, as he says they are in the areola of the egg, called cicatricula. In speaking of the latter subject, he says, "The arteries are the very first active parts of the system. We find them in action before they are connected to the heart, and in this state they are the only parts that have strength, so that we can dissect them without injection, the other parts readily giving way." He seems confident that vessels form separately, and afterwards become united with one another; and he believed that vessels might also be thus formed and conjoined in the gelatinous substances effused previously to the growth or reparation of parts.

In the union by adhesion, he supposed that though new vessels might be produced, the original divided vessels pullulated and inosculated, and became pervious and entire as they were before their division, so that blood or injection would permeate them as before. He thought, that when parts were united by a common vascular substance, the vessels and vital agency of the parts divided could gradually convert the common uniting medium into its own nature. Thus does he suppose that the nervous fibres are produced and elongated through the common uniting medium by which a divided nerve is conjoined. We see surprisingly rapid growths take place either naturally or in consequence of disease; yet at the very summit of the growth, we must admit that there are nerves, because there is feeling; that there are absorbing vessels, because there is absorption. Medicines imbibed from the surface, are conveyed into the sanguiferous system through the originally existing absorbent channels, and the blood is returned in like manner from the summit of the new-formed part; through the pre-existing veins. The original structures must therefore have grown to the very summit of the newly-produced substance, or similar parts must have been formed in it and conjoined with them.

With regard to arteries in general, he says, "That they have within themselves considerable powers of increase, both in magnitude and length, as well as of producing new shoots; all which is evident at the time of the formation of the new horns in the stag, and also in utero-gestation. Such actions, likewise, extend by sympathy to a considerable distance from the part immediately engaged in any increase of growth both in the arteries and in the returning veins."

Mr. Hunter has put up in his Museum several preparations to show the celerity with which the processes productive of union are carried on. Yet, as the effusion of injection may redden parts and give them the appearance of vascularity, so that we are liable to be deceived, I shall not refer to these preparations in evidence of this fact.

Mr. Hunter was convinced that life might remain in a dormant state, in detached parts, for sixty hours, as has been mentioned in the first lectures. He therefore could not wonder at the facts with respect to transplantation or engrafting of portions of animal bodies with which he was acquainted; yet he says that the transplanted part must have life, to accept of the union, because he believed, that a correspondent and co-operating action was necessary for its accomplishment.

Mr. Hunter observing how firmly the gum sometimes attached itself to a transplanted tooth, and thinking the comb of a cock resembled the gum in its texture, transplanted the tooth of a dog and set it in the comb, where it became firmly fixed. He next transplanted a gland taken from the abdomen of the cock, to a similar situation in the belly of a hen, where it also became attached, and as he believed, nourished, for he probably thought he had injected it from the general arterious system. The uniting medium by which it is firmly connected is certainly very vascular, yet I do not see that any injection has passed into the vessels of the transplanted gland. The preparation is in the Museum, so that you can examine it for yourselves. Mr. Hunter probably believed that it was nourished, from its neither wasting nor decaying. As, however, the evidence was not very distinct, he next transposed the spur of a young hen to the leg of the cock, and that of the latter, to the leg of the former bird, which spurs grew, and thus set the subject at rest in his mind. It may seem, however, curious, that the hen's spur grew to a greater size on the cock's leg than it would have done upon the parent animal, which Mr. Hunter considered as a proof of the greater vigour of constitution of the male bird.

Next to the organs concerned in the circulation and aeration of the blood, Mr. Hunter displays the various kinds of kidnies allotted to different animals as a specimen of glands in general, and as the agents by which the impurities are carried off from the circulating blood. Carbon and water, with trivial quantities of saline and animal substances, are discharged from that fluid from the surfaces of the body, both from the skin and lungs. The kidneys also carry off redundant water from the blood, which is a proper vehicle for salts casually received or accidentally formed; but which is likewise made to suspend various kinds of solid animal matter. As many of the old materials of the body, and some of the unassimilated matter of our food, are insoluble in water, nature has given the kidnies powers of converting various kinds of animal matter into a peculiar and very soluble substance, lately recognized and denominated urea. So soluble is it that we may evaporate the water of the urine to a considerable degree without precipitating the urea; and when we add large quantities of water to urine, the urea will pervade the whole, and be dissolved in it, so as to be distinguishable in every portion by appropriate tests. Lime removed from our bones, or taken into the circulating vessels with our food, becomes also dissolved in the water of the urine by means of phosphoric acid, which the human kidney prepares in so large a proportion, that the superfluous acid will redden the vegetable blue, and dissolve more lime than is usually found in urine. That the phosphoric acid could not exist formally in the blood, but is prepared in the secretory vessels of the kidney, must be evident to every one on consideration. Yet in herbivorous animals. who take into the circulation a great deal of flint with their food, the urine is rendered alkaline in order to dissolve that kind of earth.

I have been induced thus briefly to advert to the functions of the kidney, because the quantity and quality of its products can be ascertained, and thus throw light upon the subject of secretion in general. When water abounds in the blood, whether from more being imbibed from the digestive organs, or less being carried off from the surfaces of our bodies, the quantity separated by the kidney is proportionately increased, and *vice versa*. Thus do the secretions become vicarious to one another, and conjointly tend to maintain the proper quantity and quality of the circulating fluids.

The qualities of the urine also demonstrate how much secretion is effected by different states of the nervous system in

general. When the kidney is rendered irritable from various causes, and persons are in that state usually termed hysterical, it scarcely separates any thing but water from the blood, which is, indeed, produced in an inordinate quantity; and it is probable, that a different state of the nervous system, may render the kidney incompetent to transform the animal matter into urea, and thus prove a cause of foul and deficient urine. How curiously and universally are the nervous functions sometimes disturbed by trivial causes? Even harsh and discordant sounds, affecting the brain, may disturb the functions of the kidney; so that there may be some who, "when the bagpipe sings in the nose, cannot contain their urine."

Those of the medical profession must readily accord with the additional remark of Shakspeare, that such affections, which may well, indeed, be called "masters of passion, sway us to their mood in what we like or loathe." For we well know, that our patients and ourselves, from disturbance of the nervous functions of the digestive organs, producing such affections of the brain, may become irritable, petulant, and violent about trifles, or oppressed, morose, and desponding. Permit me, however, to add, that those of the medical profession must be equally apprized, that when the functions of the mind are not disturbed by such affections, it displays great energy of thought, and evidence of established character, even in death. Have we not lately heard, that the last words of Nelson, were, "Tell Collingwood to bring the fleet to an anchor?" Shakspeare has also represented Mercutio continuing to jest, though conscious he was mortally wounded; the expiring Hotspur, thinking of nothing, but honour; and the dying Falstaff still cracking his jests upon Bardolph's nose. I request you to excuse this digression, which I have been induced to make from perceiving, that if such facts were duly attended to, they would prompt us to make a more liberal allowance for each other's conduct under certain circumstances, than we are accustomed to do; and also incite us to the more active and constant performance of the great business of human life, the education of the mind; for, according to its knowledge and dispositions, do we possess the ability of contributing both to our own welfare and comfort, and to those of others.

The saccharine diabetes is a disorder which elucidates in a very striking manner the nature and effect of the vital actions in the process of secretion. If the stomach does not digest vegetable food, so considerable a portion of it is some-

times imbibed from the bowels, as to render the serum of the blood turbid, though not sweet. In the kidney, the vital actions combine the vegetable substance into something resembling sugar, which, being very soluble in the water of the urine, in this form obtains an outlet from the body. Thus those who have trivial and temporary incompetency to digest vegetable food, have also a corresponding degree of saccharine diabetes, which is often unnoticed; but when the disorder of the stomach causing this failure of digestion is established and permanent, the diabetes is constant, if vegetable substances be eaten.*

ON THE ORGANS OF PERCEPTION AND VOLITION.

After the exhibition of the organs by which animals are nourished, their curious structures built up, and their various liquors and substances prepared, Mr. Hunter shows the nervous system, or the means by which parts of the body seem to have sympathetic communication with one another, and with the brain, which is commonly believed to be the organ of sensation and volition. I have nothing to add with respect to this subject in general, to what is contained in the introductory lectures. When I wrote them, I had not indeed attended to Mr. Hunter's views of the nervous system in the lower kinds of animals; neither had I read Professor Cuvier's Lectures. It is therefore proper, on the present occasion, to mention that both these zealous and industrious enquirers into the structure of animals, seem to acknowledge that there are some beings, in which they have not been able to discover any regular nervous system; yet upon dissecting them, they meet with fibres which they believe to be nerves. Mr. Hunter has shown these kind of threads in the sipunculus nudus.

In animals of the worm kind, which are formed of a series of rings, the nervous system is also composed of an equal se-

* In saying this, I by no means deny that diabetes may not also result from disturbed vital actions in the kidney. Dr. Sanders, of Edinburgh, informs me that he has of late particularly attended to the state of the medulla spinalis and vertebral nerves, both in chorea and diabetes, and that he finds their vessels very turgid, with other signs indicative of their having been in a state of considerable disorder; which state, in diabetes, however, may either be a cause or effect of renal irritation.

ries of connected ganglia, each ganglion supplying that ring of the animal to which it corresponds, so that each ring may be considered as possessing a perfect nervous system. The connection between the ganglia may also be supposed to produce effects which I have endeavoured to express in my first lectures by the words "concurrence of impressions and actions." When animals, whose nervous system is thus constructed, have such sensations as we possess, and recognize in the higher classes of animals, when they are sensible of light, sound, odour, and touch, the upper ganglion which surrounds the œsophagus must be considered as the brain, and from this, nerves may be traced to the eyes, antennæ, and feelers. Mr. Astley Cooper tells me, if the longitudinal nerve be divided in the earth-worm, it can no longer regulate its motions. When a worm is divided, each part moves and crawls by its own powers, but if the longitudinal nerve be divided, when the worm is entire, the motions of either end so counteract each other, that the animal cannot crawl, which shows that the volition of the worm proceeds from its brain, and cannot operate on the parts beyond the divided nerve.

In insects and crustacea, the nervous system is similar to that of worms.

In molusca, there is no longitudinal source of nerves analogous to the medulla spinalis. There is an upper ganglion, similar to that considered as the brain in the animals just mentioned, and a lower one to supply the viscera and the rest of the body. Mr. Hunter says in his MS., "There are two large nerves descending on either side of the œsophagus, and then uniting into one, forming a ganglion at their union, which he thinks serves the office of the sympathetic or visceral nerve, and the medulla spinalis."

In fish and reptiles, the nervous system approximates to that which is found in the higher classes of animals. In the former, it is extremely small. The brain and medulla spinalis of the squalus maximus is exhibited in the Museum. It therefore appears that fish, such agile, powerful, indefatigable creatures, which are also so surprizingly retentive of life, have not only a very languid circulation, scanty respiratory process, but also a disproportionately small nervous system. We need not indeed marvel at such facts, because the animals in which the energies of life seem greatest, are those in which neither circulating organs nor nerves are discoverable.

Mr. Hunter has in his MS. particularly described the various forms of the brain in the lower classes of animals, and

has exhibited specimens, showing its varieties, in his Museum. As this organ becomes large and complex, so, it is well known, do animals proportionately possess various perceptions, propensities, faculties, and sentiments; which induced Mr. Hunter to believe that it was the organ of sensation and other properties originating in that source.

These circumstances being shown, the different organs of sense are next exhibited; and the structure of the eye of the fish and bird appears to have been particularly examined and contrasted by Mr. Hunter. But I must not enter into this subject, for it would be useless to begin without proceeding; and if I proceeded, I should weary both myself and my audience before I returned to the point from which I had set out. Neither do I perceive that any conclusion can be drawn from the most patient investigation of the subject, except that which has been deduced in the introductory lectures; that vibratory actions occurring in the nerves, in consequence of impressions made on them, are transmitted to the brain, and variously affect that which is perceptive. It is evident to reason that our perceptions have no rational correspondence to the causes producing them; and nature may have allotted to animals various kinds and degrees of perception adapted to their wants, and the situation they occupy in the scale of existence. No one can guess what kind of vision belongs to the fly. There are probably 25,000 hexagonal lenses or menisci on its surface, or the same number of distinct visual organs, as some comparative anatomists would have us to believe. Some animals may have great susceptibility to light, odour, and sound, and yet may not possess great general susceptibility. We find indeed, in many instances, organization adapted to function, and yet it is highly improbable that we shall ever be able to explain function by means of our knowledge of organization.

Having promised to endeavour to confirm, by additional physiological arguments, the theory of nervous and muscular actions proposed in my first lectures, I proceed to redeem this pledge. That life continues in detached parts of vegetables and animals, seems evident, from the continuance of irritability; and to this subject only, I excited your attention in the introductory lectures. On the present occasion, I wish you to consider, that all the vital functions are, occasionally, equally manifest in the detached part; for when such parts possess powers of supplying and distributing nourishment, growth and formation will continue, so that the detached part

becomes as perfect and complete as the body from which it was removed. This happens in vegetables and zoophytes.

In animals of more complicated structure, also, reproduction of parts takes place, to a degree that often excites wonder, because we are apt to judge of other things by ourselves, or by those which we are most accustomed to observe. The claws of lobsters, when torn off, are renewed. It is said, that the divided parts of an earth-worm, if cut in two, will each become perfect; and that the head of the snail, and eye of the newt, will grow again, when removed. Yet, I would ask, what is there in these facts more surprizing, than in the reproduction of the stag's horns, and of the plumage of birds; or in the formation of superfluous limbs in the fœtus, or of monstrous excrescences in the adult? All parts are originally formed by vessels; and why may not these agents form them anew, or produce them superfluously?

In the lower kinds of animals, different parts of the body may each be considered as possessing a perfect nervous system. Those animals which are capable of great degrees of the reproductive processes, have great tenacity of life, and powers of continuing its functions without the ordinary supply of food. It is said, that frogs and toads have lived in hollows of wood and stones, so that it is probable they were supported only on the reputed "cameleon's dish," the air, and the moisture it contains. Snails will live when covered up in a glazed pan for more than a year. Now, though I do not, under such circumstances, see any thing astonishing in the instances of reproduction which are reported to have taken place, yet I should hesitate to admit that the brain was ever perfectly reproduced, till such a fact was established by observations on the future life of the animal, and by subsequent accurate anatomical examination. As far as I have observed, divided earth-worms, and most decapitated snails, perish; and I know that we may decollate the latter very completely, and yet but partially remove the brain; the reproduction of which would not then appear so wonderful, for even in the higher classes of animals, the life of parts seems to operate so as to convert surrounding substances into their own nature and structure.

In the higher classes of animals, in which distinct organs are allotted for carrying on the vital functions, if parts be detached, they necessarily perish, for the springs of the vital actions are removed. There can be no supply of blood or nervous energy, for the detached parts are cut off from their

sources. There is no manifestation of the existence of life in the detached part, except by the delay of putrefaction, and the continuance, for a time, of the phænomena of irritability.

To this striking evidence of the existence of life in detached parts, I directed your attention in the introductory lectures; nor do I perceive any reason to add to what was then said, in order to persuade an unprejudiced person that it is a superadded power, only inherent in the visible structures to which it is connected. But on the present occasion, I would ask, whether irritability alone is capable of causing all the phænomena which take place in the reproductive processes I have now referred to? Can it alone produce assimilation and decomposition, and all the varieties of growth and organization? Those who think the phænomena of life depend on organization, must necessarily suppose as many kinds of life as of structures, and still assign no cause for the production of such structures. Those who think that irritability depends upon nerves, must do so by a violation of their own principles, for they must *suppose* the hydatid to have nerves, though none can be demonstrated, even by the aid of the microscope. Yet if they choose to contend that the phænomena of irritability in detached parts which possess nerves are maintained by their presence, it is impossible to refute them, for we cannot remove the nerves without destroying the irritable substance. The arguments which invalidate their supposition are, that irritability exists where we have no evidence of nerves, and that it bears no proportion to the magnitude of the nervous system.

From the perplexities and obscurity of other opinions, let me turn you attention for a moment to contemplate the simplicity and clearness of Mr. Hunter's Theory of Life. In all its functions he recognized an active principle, capable of producing motions in matter that would not move without it, and of controlling motions to which, from other causes, such matter has a propensity, and of exerting its powers in different modes and degrees in the structures or substances in which it inhered. He thought that a similar vital principle was diffused throughout the body in different degrees, and to use the expressions with which his friends have furnished him, that the materia vitæ diffusa communicated with the vital energies of the brain, by means of actions transmitted through the nerves or internunciate chords, as he called them; he also considered these actions to be productive of the sympathetic

effects referred to in the introductory lectures, and which are wholly unintelligible upon any other supposition.

In forming our opinions on the subject of sensation, I admit that a choice of difficulties is presented to us; and I prefer that which seems the least. If I judge, as I own is natural, of other things by myself, I shall be led into a dilemma that a man of great intellectual powers and acquirements has been, and whom I have already praised for the important additions he has made to our knowledge of the functions of the nervous system. As we perform certain actions in consequence of reasoning, he was induced to believe that brutes act in a similar manner from a similar cause. Regardless of the opinions of great numbers of highly intellectual men, that instinct is a blind impulse, unconscious of the end which it effects, he maintains his own, and is consequently obliged, as he proceeds, to suppose that brutes have tradition. But I am sure, had he continued to examine their actions to the extent he might have done, he would have been compelled, either to relinquish his dogma, or to assert things still more incredible. It would require more intellect and ability than falls to the lot of any human individual, by experiment, induction, contrivance, and practice, to accomplish what animals perform without education or communication with one another. The full consideration of this subject, induced a philosopher to conclude, that the actions of animals were the result of laws established by an intelligent cause, and to express the opinion by the brief but emphatic exclamation: "*Deus est anima brutorum.*" Yet further, as animals perform certain actions in consequence of feeling, the gentleman alluded to is led on to suppose, that similar actions in vegetables are also the result of feeling; nay, he even attributes to them the more subtile sensations of smell and taste, and believes them to be undoubtedly actuated by the passion of love. As he has published all this in a scientific work, containing many highly valuable observations, I conclude that he was firmly convinced of what he has asserted; which shows how opinions are acquired and established. We have only to think in a certain manner repeatedly, and we shall become convinced of what at first might have appeared doubtful, or even improbable. It is therefore prudent, before we indulge in certain trains of thought, and suffer them to become habitual and predominant, to consider their ultimate tendency and probable influence on our conduct, both with respect to ourselves and others. It is surely right, be-

fore we enter a path which we mean to pursue, to enquire whither it may lead us.

The long continuance of life, when the brain is removed in tortoises, the dissections of that organ by Doctors Gall and Spurzheim, the late experiments of Le Gallois and Dr. Wilson Phillip, showing that the vital functions can be carried on in warm as well as in cold blooded animals, after the brain has been removed, provided, indeed, artificial respiration be kept up in the former class, all tend to show, what Comparative Anatomy also teaches, that the brain is not essential to the vital functions. There are animals which have no brains, and in proportion as they possess them, so do they appear to have sensation, volition, and other faculties. Every portion of newly acquired knowledge only corroborates the already well established opinion, that sensation, volition, and the intellectual faculties are connected with the brain alone.

The experiments of M. Le Gallois show that there is an analogy in the functions of the medulla spinalis in the higher and lower classes of animals. In the latter, it is a series of connected gangalia, each supplying the portion of the body to which it corresponds; and even in quadrupeds we sometimes observe the medulla spinalis to swell out in portions, so as to appear like a series of connected ganglia, as is evident in the preparation which Mr. Hunter has exhibited of that part in the lion. The experiments of M. Le Gallois, show that the nervous influence of portions of the body, corresponds with that part of the medulla spinalis to which their nerves are connected; that it forms a kind of centre from which nervous actions radiate, and to which they tend. Yet according to the view I have exhibited of the nervous functions in the introductory lectures, it appears necessary that such actions should be transmitted to and from the brain in order to communicate sensation and volition.

M. Le Gallois seems, however, to suppose, that sensation continues in the medulla spinalis after the brain is removed. Now were I to entertain the same opinion, I might be led on to suppose that a duck decapitated by the side of a pond, which has been known to run a few steps into the water, and swim a few strokes from the shore, was voluntarily taking refuge from injury in an element where it had formerly found security, was gratified by the feeling derived from it, and elated at accomplishing its object. The mind revolts from the supposition that nature would have formed the lower kinds of animals doomed to destruction. so defenceless, or,

that they should repair the injuries they sustained in the manner they are known to do, did they possess the sensibility of the higher classes. Sensation seems allotted to animals in different degrees, and faculties adapted to their peculiar situation. Were it however possible that I should believe all that seems required of me, and go on to attempt to account for the phænomena of life upon such principles, I know eventually I should be compelled to believe that atoms were sentient, and intelligence universal.

The opinion that sensation, volition, and other faculties attendant on perception, are connected with the brain alone is natural to most men, confirmed by reasons so strong and clear, that they have convinced those of the greatest intellect in different æras and countries, and it is corroborated by all the discoveries in science. I have already observed, that we know nothing but the properties of the different substances we recognize in nature; of the subject which supports these properties we seem, in every instance, to be equally ignorant. Mr. Hunter's proposition, that the phænomena of life are produced by something which is superadded to structure, cannot, I think, be disputed. But if this be granted, the facts which have been mentioned, call upon us also to admit, that life is not essentially perceptive; and I further contend, that reason absolutely prohibits our supposing, that perception, with its concomitant attributes of consciousness and volition, and its various attendant faculties, propensities, and sentiments, can be the result of any arrangement or motion of insensible atoms. I know, indeed, I may be asked how I can suppose a distinct sentient principle to be formed, added, or connected? To which I answer, it is impossible to entertain any supposition on these subjects, because we can have no knowledge but what is derived from our perceptions. Yet I can firmly believe, that there may be, and are things, of the nature of which we can never entertain the least idea, from their having no correspondence to the objects of our senses. To me it seems, that true philosophy shows us the imperfection of our senses, and limitation of our powers; so that by a kind of light which it elicits from our own ignorance, it instructs us in the lessons of humility.

By adopting the opinions which I feel it my duty to inculcate, we not only avoid many difficulties and absurdities, but also perceive the scheme of nature to be beautiful and benevolent; and we are excited to actions useful to others, and honourable to ourselves. Nature has given life and active

power to vegetables, which occasionally evinces its activity, even in them, by irritable motions. The irritable actions of life are however more particularly allotted to the animal kingdom. She has superadded to life sensation, but confined the sentient principle to the brain alone, and yet enabled it to perceive all that happens in the body, and even in remote objects, as well as to regulate those actions which may contribute to the welfare of the perceptive individual. She has allotted sensation and faculties in various degrees to animals, adapting both their feelings and dispositions to the situation they occupy in the graduated scale of existence. She has made man in the highest degree sensitive and intelligent. She has given him reason and sentiments of so exalted and commanding a nature, that under their excitement he will sustain and encounter what his nature as an animal most dreads and abhors. At the call of honour, or under the conviction of right, he will endure torture with seeming apathy or derision, and welcome death with smiles. In the exercise of his intellectual powers he is abstracted from his body, and unconscious of its existence. But I forbear to say more; for I have not received the appointment of professor of moral philosophy to the college. Yet it is a part of my duty to place before you, Gentlemen, a specimen of what I believe to be the ancient Greek philosophy of life, and a sample of some modern French physiology on the same subject, for your consideration and choice.

Now though I have forborne to consider the structure of the organs of sense in general, I wish to say a few words on that of the human skin, which is capable, in all its parts, of distinguishing what are called the tangible properties of substances, because the skin forms the surface of the body, and there is probably an analogy in the coverings of all kinds of animals. Had the skin been exposed to the air, it would have either become dry and horny from evaporation, as we see in the dead subject when the cuticle is removed, or encrusted, from the same cause, by the residue of the fluids it pours forth. It is therefore necessary that it should be defended by an outer garment impermeable to moisture. The cuticle, which seems a compact, though thin substance, through which the water effused beneath it, when we are blistered, does not even transude, appears well calculated

for this purpose. It is most exactly fitted to the surface of the true skin, descending into every groove, and rising over every eminence. Yet however neatly fitted this water-proof garment may be, it would be liable to be wrinkled or displaced by friction, were it not firmly connected to the skin by a net-work of very minute, soft, and seemingly mucaginous fibres, which are therefore denominated the rete mucosum. This part is variously coloured in different persons; it is tawny in some, freckled in others, and black in the African. These investments of the skin do not appear to be sensible, and doubts have been entertained whether they are in any degree vascular.

We must, however, I think, admit that vessels arrive at the surface of the cuticle, through which gaseous and watery fluids containing some mucilaginous and saline substances are eliminated from the circulating system. We see the sweat escaping from regular pores, and not irregularly transuding, as if it passed through interstices in the cuticle. Substances rubbed on the skin gain entrance into the absorbing vessels, and it is very improbable that they pass through the compact cuticle, in order to arrive at their orifices. We see the ducts of the oil-bags terminating on the surface of the cuticle. It seems here right to observe, that myriads of oil-bags are disseminated throughout the skin, from which ducts proceed to the surface of the cuticle to anoint it every where; and that it is most liberally oiled in parts subject to the greatest friction or evaporation. If we throw water upon our arms, we find it repelled in globules, as from a greased surface. Every hair also receives a small covering from the cuticle, as it penetrates that substance; which covering so tenaciously adheres to it, that in taking off the cuticle, when the skin is slightly putrid, we tear the bulbs of the hair from the beds in which they grew, and they remain firmly connected to the cuticle in consequence of this investment.

There are processes of the skin entering the interior of animals; and though these differ materially from it in appearance, yet an analogy of structure may be traced in them, so that they may fairly be considered as internal skins. Their surfaces to which also the air may have access, are every where besmeared with mucus, and therefore they are commonly called the mucous membranes of animals. Mucus is an animal substance, admirably adapted for the defence of the surfaces which it covers. It is mild and unstimulating, possessing a viscidity which causes it to cling to the

surface it is designed to defend, and being particularly immiscible with other fluids, it is not likely to be removed by the liquids contained in cavities formed of such membranes, or even by the current of fluid when passing through tubes of the same construction. In evidence of this, I may mention, that the surfaces of fish are smeared over with mucus, which is liberally poured out from the orifices of numerous ducts, rendering the surface of these animals particularly slippery, preventing also any adhesion between them and the element in which they move, and serving the same purpose in facilitating their transit through the water, that greasing the bottom of a boat is known to do. Yet though they swim through the water with such celérity, the skin is never denuded of mucus.

There are intermediate surfaces in animal bodies, between those which I have described as external and internal skins, and these are also defended by appropriate lackers, which, however, I shall not detain you by describing. Yet I wish you to observe, how admirably the cerumen of the ear is adapted, from its obvious qualities, to defend and keep moist that process of the skin which lines the tube of the ear. Its tenacity causes it to cling to the surface it is designed to protect; it is not liable to dry into a crust, as mucus does, nor to become rancid and acrid, like oil. Its bitterness, they say, also renders it disgusting to insects, which might in our sleep seek to nestle in that passage. The necessity for the lining of the tube of the ear being kept constantly moist is evident, for when the cerumen is deficient in quantity, or faulty in quality, then the oscillations of sound, or the pulsation of the vessels, produce vibrations in the tube, causing noises, which patients compare to the rustling of leaves, or the gushing of waters, and the beating of hammers.

Though the exact structure of the coverings of animals appears to be less accurately known than that of most other parts, yet from the general consideration of the subject, I think we are warranted in concluding, that Nature has either, from the texture of the substances with which she has invested them, or the qualities of those with which they are besmeared, cut off all communication between the interior of living beings, and the elements in which they live, except what takes place through tubes or passages which she herself has formed. Even in vegetables we observe some surfaces besmeared with adhesive wax, others varnished with resin, whilst the grasses are glazed with transparent flint.

After the exhibition of the structures already adverted to, Mr. Hunter calls our attention to the fat of animals, which he considers as not actually making a part of the body, the animal being much the same with or without it. We find his attention, however, excited by the great increase of fat in hybernating animals, prior to their becoming torpid; and there are contained in his MS. many observations and experiments which he requested his pupil, Dr. Jenner, to make for him, relative to this subject, in hedgehogs.

The exterior coverings of animals are next shown, which are to be considered as their clothing or their armour, and respecting them, it seems worthy of remark, that they are all made of the same kind of material, which is impenetrable to moisture. Hairs, feathers, scales, and horny cuticle, resemble each other in this particular, and also in their chemical analysis.

Mr. Hunter has shown the analogy of the formation of feathers and hairs. Each is formed by a vascular substance, which ascends to some distance up their shafts. Hairs are bulbous rooted, and the stronger ones are more deeply implanted in the skin. The capsule of the bulb, which is tough and shining, being opened, is found to contain a very vascular pulp which can be injected, and ascends up the shaft of the hair so as successively to form it at the bottom; and thus to increase its length. I cannot suppose this circumstance was commonly known at the time Mr. Hunter made these preparations, for a knowledge of this fact much diminishes our surprise at the accounts we have received of the plica polonica, in which disease the hairs are said to be ill-formed, matted, and to bleed from their roots.

The hairs are sometimes straight, and sometimes curved or waving, and when of the latter kind they intermix and form a fleece. In birds and beasts the stronger hairs and feathers make an external coat, and beneath this we find a downy or furry vestment of the same parts, but of a more delicate structure.

These garments of animals are, from their texture, bad conductors of heat, and well calculated to prevent external heat or cold from affecting the animal temperature.

The garments of animals also exclude moisture, from being oiled, either by unctuous fluids transuding from the skin, or from their being applied by the voluntary act of the animal; Nature having given to birds in common, and particularly to

those that are aquatic, as well as to many animals, oil-bags for that purpose.

The coverings of many animals seem merely designed for their defence, as the shells of tortoises, armadillos, and the scales of the manis. The coarse scales and spines of fishes, the bucklers of the sturgeon, and hard projections of the skin of the crocodile, all serve the same purposes. The porcupine and hedgehog have quills like those of birds, but they want the fibrous part or plumage, and are remarkably strong and pointed. They may indeed be considered as a defence to the animal, when they lie horizontally; but as it is well known these animals, when attacked, suddenly squat down, bringing their fore and hind legs near together, and putting their head between their fore-legs, then contracting their skin in a direction towards their belly, by an appropriate muscle, the quills are raised, and a chevaux de frise of pointed spears presented in every direction to the assailant. When the horny or crustaceous investments of animals are of one piece and unyielding, there is a necessity, whilst the animal is growing, for casting these coverings and forming new ones, adapted to the increased bulk of the animal; and we find that snakes and lobsters thus cast their skins or shells.

Mr. Hunter next displays the weapons and instruments which Nature has allotted to animals; and here we find exhibited the spurs of the cock, the retractile nails of the cat kind, which must be considered as weapons; whilst the fixed nails of other kinds of animals may be regarded as instruments, with which they scratch or burrow. The hoof of the horse is shown; for it is used as a weapon. The horns of animals, being displayed elsewhere, are not included in this department of the Museum.

The teeth seem to have been considered by Mr. Hunter chiefly as weapons and instruments. Though teeth do not usually grow, yet those in the front of the mouth of the animals, now called rodentia, are continually growing, so that they project and prevent the animal from masticating, if not worn down by gnawing, according to the intention of nature. The venom bags, and tubular teeth, or fangs of serpents, by which the wound is inflicted and the poison injected, are shown, and also the stings of scorpions, bees and wasps.

Those animals which cannot hunt their prey, and would become victims of its resistance, can, by such means, instantly deprive it of power, and speedily of life. Such animals also as depend upon casualty for support, are generally formed to

sustain long abstinence without that decline of power which occurs in others, and for the occasional digestion of enormous quantities of food. It is, however, but a small part of the highly interesting subject, of the means by which various animals obtain their sustenance, that falls within the province of the Comparative Anatomist to discuss; it is that part only which relates to structure, the rest belonging to the Natural Historian. The proboscis of animals is to be considered as an instrument, and that of the elephant is here shown.

In this department of his Museum, Mr. Hunter also displays the electrical organs of the torpedo and gymnotus, his account of which is published in the Philosophical Transactions. I have already suggested in the first lectures, what reflections they probably induced. He has put up equal portions of the brain and medulla spinalis of the raia torpedo, and a more common ray fish of equal size, so that they appear like the front and back view of the same preparation, in order to show the disproportion, and the immense size of the nerves which go to the electrical organs. How strange and unexpected is this mode of defence and assault, which probably palsies the prey or assailant. Even the polype seems to have a power of inflicting sudden death; but by what means, is not, I believe, ascertained. The worm which it seizes, is swallowed without resistance, or its struggles would lacerate the tender body of its devourer. I have thus, as briefly as possible, told you what are the facts, and their arrangement, which Mr. Hunter has exhibited, relative to these parts of the animal economy in general.

An adherence to the chief object of these lectures, which is to exhibit Mr. Hunter's opinions relative to the principal vital functions, has obliged me to hurry through these last departments of the Museum, and prevented me from noticing many interesting facts belonging to less important parts of the subject. I may, however, mention that Mr. Clift informs me, when Dr. Schreibers, of Vienna, whose account of the anatomy of the siren lacertina is published in the Philosophical Transactions of the year 1801, (which is the only animal known to possess both lungs and gills, and consequently fitted to live both in air and water,) inspected the preparations of the pulmonary and other organs of that animal contained in the Museum, he was surprized to find that Mr. Hunter knew nearly, if not all the facts relating to its anatomy, which he himself had been able to communicate to the public. Two species of the siren were examined by Mr.

Hunter, one of which was brought from South Carolina, in 1758, and afterwards bought by him. Also, after Dr. Latham had published his account of the conformation of the larynges of various birds,* he was surprized to find that Mr. Hunter had exhibited most of the facts contained in his paper on that subject, and several varieties, with which he was unacquainted, but which he deemed worthy of being communicated to the public. Now almost all the preparations in the Hunterian Collection were made before the year 1780, and have been publicly exhibited since the year 1783. We must, therefore, consider Mr. Hunter as the discoverer of all the facts, ascertained by his preparations, that were not publicly known before that time; whilst the open evidence and communication of his labours entitle him further to be regarded as the prime mover in those investigations, and as the source of that light, by which the subject of the comparative structure and functions of living beings in general, has of late been so highly illumined.

LECTURE VII.

IT is one of the characteristics of livings being, that they multiply their species; which they sometimes effect in consequence of subdivisions of their bodies, or by the production of shoots, that afterwards become detached. Both these modes are evident in vegetables and polypes. In general, however, the multiplication of the species is effected by the production of seeds and eggs, containing nutriment for the germ of the future vegetable or animal, which, thus supported, grows till it acquires powers of deriving nourishment from other sources. Those animals, which multiply their species in this manner, are said to be oviparous. Sometimes the ova seem to be hatched within the body of the parent, and, under such circumstances, the animals are said to be ovoviviparous. This mode of multiplication is frequent in the lower kinds of animals, but it is met with also in the class mammalia, amongst the oppossum tribe. From observing the peculiarities of structure in the sexual organs of the animals last mentioned, Mr. Hunter was convinced that they did not produce their young like other quadrupeds; yet he was unabled to

* Linnean Transactions, Vol. iv.

get the American oppossum to breed in this country. The facts have been ascertained, since our more free communication with New-Holland. That large animal, the Kangaroo, produces a young one, not exceeding twenty grains in weight, which is received into the abdominal pouch of its parent, and being there protected from cold and injury, clings to the nipple of its mother, and takes sustenance according to its wants. It is curious to observe the difference of form between the parent and its young offspring. The mother has monstrous hind legs, by which she springs to a surprizing distance, whilst her fore paws are very diminutive, serving merely to feed and to scratch with. On the contrary, the young Kangaroo has monstrous fore-paws, with which it clings to the nipple of its mother, and scarcely any hind legs; so that its form, at its birth, is suited to its present exigencies, and not to its future modes of life. By degrees, the young Kangaroo fills and distends the abdominal pouch, and peeps abroad through its aperture, which gives the first intimation to others, that its parent has become a mother.

The common mode of the multiplication of the species, in the higher order of animals, consists in the exceedingly minute ovum, containing no nutriment for the growth of the embryon, but merely its germ. Yet this possesses powers of extracting nourishment from the vessels of its mother; and when the young has attained a certain degree of perfection, it is expelled from her body, and is, or will become, a miniature resemblance of its progenitors. Animals that bring forth their young in this manner are called viviparous.

There are organs allotted for the formation of the ovum called female, but it never increases beyond a certain point, unless excited by the application of a peculiarly stimulating substance prepared by other organs, called male. Sometimes both kinds of organs are found in the same vegetable or animal, and sometimes the organs of each sex are allotted to different individuals. How far the prerogative of the female organs may extend with respect to their power of forming the rudiments or primordia of the embryon before the peculiar stimulus is applied which is said to fecundate the ovum, is probably unknown. The female organs of plants, will, I believe, prepare a seed, though no fecundation has taken place. The progress of the formation of the young vegetable in the seeds of different plants is known to vary considerably. In the common bean, the plumula or first shoot is very evident, and even well formed. Experiments

on vegetables might tend to elucidate the extent of the powers allotted to the female organs. Frogs and fish prepare and exclude their membranaceous ova prior to fecundation; and some degree of organization is discoverable in that part which would produce the embryon, if fecundated. Female birds prepare and deposit their crustaceous ova when secluded from the presence of the male. From the magnitude of some of them, and the facility with which they are obtained, they have been made subjects of interesting examination by various physiologists.

Mr. Hunter began his examination in those of the hen and goose in the year 1755, and the industry and accuracy with which he noted all the changes occurring during incubation are evident. He has put up in his Museum two sets of eggs, showing these changes from the first few hours of incubation to the maturity of the chick, and consequent conclusion of that process. As many of the appearances, however, are evanescent, or destructible by immersion in spirits, he procured beautiful drawings to be made of them by the best artists. It seems proper to mention, for it exhibits the peculiar character of his mind, that at the time of his death he was engaged in some additional investigations of the same subject.

These were the inquiries by which he was chiefly convinced that life was a great architect. He believed that vital actions begin simultaneously in various parts of the semi-opake and whitish areola which is called the cicatricula. He says that there is a zone of bloody points at a distance from the part where the rudiments of the chick begin to form. He suspects that blood is first formed, and vessels afterwards. He is certain that vessels forming in different parts of the areola, afterwards coalesce, and that the fœtus is not developed, but built up.* I kept some pullets last winter secluded from the male bird, and Mr. Clift examined the cicatricula of the eggs which they laid in the spring by the microscope, without being able to observe any difference in the organization of the cicatricula of these and other eggs. He says, that there is the same appearance of opake spots in the circumference of the areola at a little distance from its disk, and the same kind of central opacity, which, after the heat of incubation has been applied for some time, become, accord-

* I have already mentioned that he believed that the vital processes were carried on in the same manner in the uniting medium of parts that have been divided or removed.

ing to Mr. Hunter's description of them, a zone of bloody points where vessels form, which afterwards communicate with other vessels proceeding from the centre.

There have been some persons, who, from thinking formation impossible, have been led on to suppose that the rudiments of all mankind existed in their first parents. There are many who believe that there is some primary fibre from which all the rest are produced. I would ask them how and where they suppose this fibre to be formed? If they answer in the ovary, they even then admit Mr. Hunter's opinion, that life has the power of forming a fibre. The ovum is formed in the ovarium by a secretion from its vessels. It is impossible to suppose even a fibre to be secreted; we are therefore obliged to suppose such a fibre to be formed, either by the vessels of the ovarium, or by the vital powers inherent in the ovum.

The ovum is formed in a capsule of the ovarium, and is free to move when an aperture is produced, either, by its bursting, or ulceration. How far, I would ask, can we suppose the formative actions to have proceeded in so minute a substance as the ovum of viviparous animals? It is so minute as to be with difficulty discernible even by the microscope, nay, even after it has been for some time resident in the uterus, as has been testified both by Harvey and Hunter. Yet this atom, escaping from its cell, and failing to get into its proper receptacle, the womb, being like a seed endowed with vital powers, shoots forth roots, attaches itself to surrounding parts, extracts nourishment from them, and in due season forms a perfect but extra-uterine fœtus. Such cases, you know, are not of unfrequent occurrence. It seems, therefore, highly probable that the ovum, being endowed with plastic powers, forms its own parts, and proceeds in such formation to different degrees in different animals and vegetables; yet such actions are not continued beyond a certain point, unless the appropriate stimulus be applied to excite them.

It appears then to be the prerogative of the female organs to produce an ovum, which, when excited by the application of some substance prepared by the male, becomes capable of beginning or continuing those actions which eventually produce a new living being possessing properties and powers similar to those of its parents.

Without this magic application, plants may drop their seeds, and oviparous animals deposit their eggs, which though

they do not seem destitute of life, yet never continue its actions, but slowly decay. On the contrary, after they have received this specific excitation, they become surprizingly retentive of life; and though its actions are often suspended by adverse circumstances for a great length of time, nevertheless they afterwards may begin to build up the very curious structures of plants and animals, endowing also each structure with its appropriate degree and function of vitality. Some speculators indeed have imagined that the primordium vitæ originated in the male; an opinion that involves in it much absurdity, which I shall not attempt to expose. It seems refutable by the former argument. The stimulating substance is a secretion; and we cannot suppose that any thing which is organic can be at once secreted;—it must be built up. I beg leave to remind you, Gentlemen, that it is not my intention to dispute about Mr. Hunter's opinions, but merely to display them.

If the male merely prepares a stimulus, it is requisite that it should possess powers of peculiar excitation, and that the ovum should be endowed with a corresponding and appropriate excitability; and it seems further necessary that such appropriate peculiarities should be restricted to the individuals which belong to certain species or genera of vegetables and animals. If such properties were not thus limited, but general, hybrid productions might become common; and as the offspring resembles its parents, great diversities of vegetables and animals would be produced, so as eventually to destroy all the original and striking distinctions of form and character which Nature has instituted. Nature has also made mules in general unprolific, as if she had said, "Thus far may you go, but no farther." I know that some exceptions to this rule are occasionally to be met with, but to these the grammatical adage seems particularly appropriate, "*Exceptio probat Regulam.*"

The offspring may more particularly resemble the male or the female parent, or equally resemble both, as is evident in the common mule. Now, thinking as Mr. Hunter did about the formation of the embryon and its future growth, this resemblance must have appeared to him extremely curious; and he used, in his lectures, to record every instance that came within his own knowledge, with his usual accuracy and fidelity. He recited instances of children who had never seen their parents, resembling them, not only most exactly in form, but also in manners, and

in peculiar and whimsical habits. He mentioned also cases where children acquired the same diseases at the same period of life to which the parent had also been subject at the same age. He dwelt upon the resemblance of twins, and (as in his lectures on sympathies) actually wearied his audience by the number of facts he recorded, and the minuteness and accuracy with which he detailed them.

Such instances, however, are not only curious, as demonstrative of the powers and progress of the vital actions, but they also deserve general consideration; for children resemble their parents not only in person but in mind. Nature has made us to love youth, health, and beauty of form; to delight in amiable dispositions, and admire various kinds of intellectual excellence. She has given us propensities which tend to perfectionate the human race; but we, for mere lucre, become wedded to age, disease, and deformity, malignity, folly, and even insanity. "*Quid non mortalia pectora cogis, auri sacra fames!*" But if, like Prometheus, we presume to give life in opposition to the laws of Nature, we shall receive the same punishment, for our children will become the vultures that will prey upon our vitals.

In investigating this part of the works of Nature, the multiplication of the species, we perceive, as in other instances the same uniformity of design, and diversity of means; the same gradation, and seeming concatenation in their series. Yet this concatenation, though delightful and interesting to our observation, is perplexing to our understanding; for each link of the chain is perfectly independent of the other, nor does any necessity for such series and order, or seeming connection appear. Still, however, it produces on the mind effects similar to those which are derived from viewing a highly finished picture, wherein the shades and variety of light and colour are so softened down and blended together, that it is difficult to say where the one ends or the other begins.

In examining the sexual organs of vegetables, we find the males and females in general included in the same flower, and sometimes so arranged, that the pollen of the males is likely to fall upon the stigmata of the females, both of which circumstances seem calculated to ensure fecundation. Yet, in other instances, we find the male organs in one flower, and the females in another of the same plant. Again, in other instances, the male and female flowers are on different plants, so that the process of fecundation is left to be effected by the sport of winds, or the occupation of the bee, which

having collected the pollen, or bee bread, from the male flower, transports it beneath his hairy thighs to the female, which he visits, to suck the honey from its nectary; and thus undesigningly applies part of the pollen to the stigmata. When the male and female parts are included in the same flower, we find each of them varying in number from one to twenty and more. We find in some instances the males proportionately much more numerous than the females, and in others the number of females far exceeding that of the males; and we are unable to assign any adequate reasons for the facts we observe. Yet in examining all the works of Nature we find the same difficulty; we know not why those works are formed as they are. It is a problem that can only be solved after Captain Shandy's method, by saying, "It is the will of Heaven, brother," which, as he replies, is cutting the Gordian knot, without attempting to untie it.

In the seeds of most plants, much more nutritive matter is found than is necessary to supply the young plumula, till it acquires means and powers of deriving sustenance from other sources, and this surplus affords nourishment to animals which feed on such seeds or grain. In the various kinds of fruits, a great quantity of esculent matter is produced, which must be considered as designed for the food of animals. In the accomplishment of this object, we again observe an extreme diversity of means; sometimes the seeds are contained in the centre of the fruit; and sometimes set in the circumference, or surface. Sometimes the little embryon of the young plant, with the esculent substance, is included in a firm case. In those plants, which thrive every where, the seeds are light, and scattered abroad by the air; and some are curiously feathered to prolong their flight, whilst others, adapted to peculiar situations, are heavy. Even animals are made to disseminate vegetables which serve them for food; for, having eaten the seeds, some pass undigested through their bowels, and vegetate where deposited, in ground thus also manured. The seeds of some vegetables probably contain scarcely any thing but the germ of the young plant, and do not therefore vegetate, but under favouring circumstances. Those of the mushroom kind are perhaps as good an instance as can be produced. The multitudinous seeds appear to the naked eye a most subtile and light dust, which when diffused through the air, forms an evanescent cloud.

Nature has made also some animals monoicous, and placed the male and female parts in the same individual; though in

general she has allotted them to different individuals, particularly in the higher classes, and given to each its distinguishing sexual character. The male is in general the largest and the strongest; but there are exceptions to this rule, showing that this ordinance is not the result of necessity. As the vital powers of animals speedily decay and shortly cease, the production of successors becomes a most important object.* Nature has therefore given animals of different sexes the strongest propensities, so to communicate with one another as to produce the fecundation of the ovum, and she has limited this propensity to individuals of the same species, and ordained a repugnance to gratify such desires with others. She has caused such desires to occur only annually in some animals, and at different periods in others; at times, however, favourable to the production or support of the future young. The sexual organs seem to wither during the sterile interval, and most surprizingly to enlarge during the breeding season, which affords us a means of judging of what are the sexual organs in the lower kinds of animals. This temporary excitement of the vital actions, and correspondent alteration in the appearance of the organs, seem to have interested the mind of Mr. Hunter; and he has put up as a contrast, the organs which prepare the fecundating fluid of the sparrow, as they appear during these different seasons.

There is a circumstance relative to the female of the human race that deserves the consideration of the philosophical physiologist. A monthly discharge takes place from the uterine cavity; it is of a nutritive quality, resembling blood, and from its quantity, languor and weakness is induced whenever it occurs. Why Nature should have doomed the human female to the periodical loss of so much nutriment and proportionate power, is a problem that can only, in my opinion, be solved by supposing that it relieves uterine irritation, and mitigates the extreme of sexual desire; thus enabling her to conform to the laws of morality, and the social compacts that are established between us.

That Mr. Hunter viewed the whole of this subject in the light I have endeavoured to represent it, seems manifest from the arrangement he has adopted; for he has exhibited all the varieties of the sexual organs, first in vegetables and after-

* How exceedingly various is the duration of life in different vegetables and animals! Yet for this variety we can discern no adequate cause.

wards in animals. He has also shown the females as they are found before and after impregnation. His mind, however, seems to have been greatly excited by the diversity of means which Nature has contrived to secure the life of the defenceless young, and to supply it with nourishment suited to its tender age, when it is incapable of supporting itself.

In his paper on bees, he appears much interested in observing, that their eggs are deposited in separate cells, before which there is a kind of platform; that the labouring bees bring regular supplies of bee bread, at stated times for the young maggots; that when these begin to spin and assume their pupa state, the labourers close the mouth of their cells, and cease to bring them food; that they return exactly at the time when the maggot has undergone its metamorphosis and become a perfect bee; that they now unclose his cell and bring him honey, the sweet food which is to be his future support, and which he is afterwards to collect and lay by, with such incessant toil during the summer season, to serve as a common store for himself and the community, when the inclement winter has cut off those sources from which it has been obtained; and that, on the very day following his transformation, he is sent off with the swarm to participate in its provident industry.

In his paper on the secretion from the crops of brooding pigeons, he observes, that it is not alone in the class mammalia, that Nature has ordained the parent to supply nourishment to the young from its own body, for that pigeons feed their young with a secretion from their crops, which they bring up and project into the throats of their offspring. This secretion does not take place except at the required time, and it occurs chiefly in the male bird, to which the office of feeding the young is principally allotted. We account for the secretion of milk in the breasts of females, from their sympathetic connection with the other sexual organs, but the fact just mentioned cannot be accounted for in this manner, nor, indeed, upon any law of necessity. Mr. Hunter, whose habit it was to think upon every subject, seems inclined to attribute it to a feeling of fondness; for he observes, that the male bird acts in the same manner when he caresses his mate. Nor is this supposition improbable; for we know that certain feelings evidently affect the different secretory organs of our own bodies.

Mr. Hunter exhibits the nests of birds and field-mice amongst the preparations, which display the anatomical facts

relative to the nourishment and defence of the young. This seems on a par with the hyacinth root which I formerly mentioned. Neither show any thing which is not known to the most ignorant, but both evince what were his habitual thoughts, and at the same time display a simplicity of character by no means common.

Dull indeed must that mind be, which could examine the extreme variety and ingenuity of the means employed for the protection and support of the offspring, and their adequateness to the purpose for which they seem intended, without feeling the strongest excitement. The subject in general, however, belongs to the natural historian. The department of the anatomist ends; after having recounted those circumstances which relate to the structure and animal economy of living beings, that are calculated for the purposes just recited. According to this division of the subject, I may mention, that whilst some animals build nests or habitations to cherish their young, others have them formed in their own bodies. Of this I have already mentioned one instance, when speaking of the marsupial quadrupeds which are ovoviviparous. The Pipa or Surinam toad excludes its eggs like other animals of the same kind, yet the young toads become afterwards lodged in separate cells on its back. The pouches of marsupial animals are permanent, and they suckle their young, but there are no cells in the back of the Pipa during its unimpregnated state, nor do these cells appear to secrete any thing; neither have they any communication with the interior of the animal; all which circumstances Mr. Hunter took much pains to examine and display. Why this great toad should differ in this manner from others of the same kind, how the cells are formed, or the young get into them, is not I believe known; yet surely no one who has attentively examined and considered the works of Nature, can doubt of there being good and sufficient reasons for this peculiar deviation from the commonly established structure and economy of such animals.

It is from the consideration of the means by which the continuance of the different species of animals is ensured, that we derive the firmest conviction of the works of Nature being neither the effect of necessity, nor of chance; and therefore it follows that they must be the effect of causes and laws inscrutable by man. The young of some animals are born with very perfect senses and powers, so that they scarcely need maternal care. Yet as young animals cannot have

experience, and must be exposed to danger from their deficiency of size and strength, the mother generally nurses them, and directs their conduct, till they are able to procure their own sustenance, and secure or defend themselves. When the mother must seek her food, and be absent from her nursery, the young are born with scarcely any vision; whilst others have such perfect senses and powers as to be able to accompany their mother in search of food. The most helpless and imperfect offspring is that of the human race; but the long nursing which is required, creates and strengthens reciprocal attachment between it and its parents, which continues throughout life; so that according to the laws of Nature, children are disposed to return such kind attentions when age shall have reduced their parents to feebleness and second childhood. How opposite to all this is the mode by which the cuckoo species is continued? The parent has no solicitude about its young; yet Nature has taught it to ensure the continuance of the species by depositing its egg in other birds' nests. How curious is it that the just hatched cuckoo should have peculiar appendages to its wings, with which it can confine the legitimate offspring against the sides of the nest, and that it should possess instincts which cause it to protrude them one by one out of its cavity?* How curious also is the mode by which the continuance of the species of the œstrum equi is effected? Surely it is wonderful that this fly, as if endowed with intelligence, or instructed by experience, should never deposit its eggs, but in those parts of the horse to which that animal can apply its mouth, so that they may be swallowed. By this means the larvæ are provided with a warm lodging and plenty of food during the winter season, and are not expelled till spring, in order to undergo their metamorphosis into perfect flies. I must not proceed further in this endless subject, the full investigation of which has convinced the most intelligent of mankind, that the order of Nature is the result neither of necessity nor chance.

Every part seems perfect in its design, and calculated for the good of the individuals which compose it; yet these individuals are often supported at the expence or by the destruction of others. The less powerful animals herd together, and set watches to warn them of approaching danger; as they are exposed to invasion, and the destruction of their companions by the solitary and fierce tyrants of the forest that issue

* Cuckoos however have been known to hatch their own eggs.

from their secret dens. Nature has however made the animals that are liable to destruction exceedingly prolific, so that their race cannot well be exterminated; whilst she has made destructive animals in general unproductive; and when it happens otherwise, we find means which counteract their excessive multiplication. Why Nature has formed carnivorous animals, or produced such a variety of living beings, is a problem difficult to explain. Yet, this being a part of her plan, we cannot but admire the means by which it is accomplished; for every thing contributes to promote the welfare of the individuals in their proper sphere, and to ensure the continuance of their kind according to its destined proportion, so that centuries elapse without the extinction of a single species. All animals seem also to be put under the dominion of man; and as his species multiplies, it fosters and feeds the useful and innocent, and destroys those of a contrary character.

From observing the art with which predaceous animals entrap their prey, and the fury with which they destroy it, some are inclined to represent the scheme of Nature as one of fraud and rapine. Yet, surely, it is better that animals should suddenly perish for the good of others, than that they should be doomed to linger, and ultimately to starve, from that want which excess of multiplication must necessarily produce. Be it also remembered, that many of these creatures have little sensation, that all are far less sensitive than man, and that they neither anticipate the future, nor reflect on the past; so that their sufferings are transient, and necessary to general good. There are some who are inclined to represent the sufferings of animals as calamitous; but surely they have not considered that pain is Nature's monitor, and contributory to the welfare of the sufferer, by teaching it to avoid what is injurious. Neither do they seem to have reflected that it is the necessary reverse of pleasure; and that without enduring the occasional penalty of the one, we should not enjoy the more continued comfort and delight of the other.

It seems strange, that some minds appear to delight in blaming what they do not understand, and feel a repugnance to believe, that any thing may originate in causes which they cannot comprehend; and, therefore, probably they are induced to suppose a kind of necessity. All nature is full, says one reputed philosopher. Whatever can be, is; says another. But it would be far more easy to show cause why we

should believe that there is a plenum of matter, than of contrivance.

On the contrary, however, the most intelligent men who have studied the works of nature to the greatest extent, and with the greatest attention, have been convinced, that they are the results neither of necessity nor of chance; and, consequently, that intelligence must have operated in ordaining the scheme and order of the universe. The common sense of the bulk of mankind, who judge from general observation, leads them to entertain the same opinion. Both agree, that in examining the works of Nature, whatever they understand seems most admirable; and when they cease to admire, conclude that they do not understand; for "'tis but a part they see, and not the whole." They also clearly perceive that partial evil tends to general good.

You, Gentlemen, must examine this highly interesting subject for yourselves; for when I consider what might be said and shown with relation to it, I feel ashamed of the inadequateness of the representation I have given; which, nevertheless, I hope may be useful, by exciting you to enquiry. You must either form your own opinions, or confide in those of others. To form correct opinions it is necessary that all the facts belonging to any subject, should be attentively examined and considered, without prejudice or partiality; and this is no light labour. It is a task more suited to an ancient Grecian philosopher, than to one of the present school; for the latter is busied in collecting new facts, in adding to the stock of knowledge, and is consequently apt to take partial views of subjects, and not sufficiently to contemplate the general system of nature.

I have now led you round the gallery of the Museum, and have briefly informed you what probably were the designs of Mr. Hunter, in the preparation and arrangement of the subjects there exhibited. Having restricted myself to the consideration of those facts only, which form the basis of his opinions relative to the principal vital processes; I have been prevented from noticing many important circumstances, belonging to other subjects, in anatomy and physiology. The gallery of the Museum, is, however, but a small portion of it, and throughout the whole, we observe Mr. Hunter's solicitude to procure evidences of every important fact relative to the subjects in which he was so greatly interested; and also the same genius and reflection displayed, in endeavouring to interpret the works of Nature, and to arrange and concate-

nate the facts, according to their series and order, so that each should be distinctly seen, both by itself and in relation to others.

Now, though what I have said is so incommensurate to the merits of the man I have endeavoured to eulogize, or with the claims of the subject I have attempted to discuss, yet I flatter myself that I have attained the objects I had in view in writing these Lectures. I wished to show in what manner Mr. Hunter had examined the various vital processes, and also the general extent of his researches in Comparative Anatomy, and consequently from what an extensive and well arranged series of facts, his notions of life had been deduced. Yet it is almost necessary to pursue the same course of reflections, that he himself has done, to be fully aware of the intensity of thought with which he has considered many parts of the subject. In thus asserting the claims of Mr. Hunter, I hope that I shall not be considered as blind to the merits of others, or reluctant to acknowledge the valuable information which we have received from other anatomists since his time. I wished also to corroborate, by additional arguments, the opinions I merely alluded to in my former lectures, and which I consider to be those of the most intellectual of the Greek philosophers, that perceptivity, and the various properties of mind, are not attributes of mere life, but probably of a distinct substance.

Mr. Hunter's Theory of Life has however been said to be absurd and untenable, and even has been held up to ridicule by those attached to the physiological opinions that have chiefly issued from some of the writers of the French school. What those, who are advocates for such opinions think, it is difficult to determine, because they do not explicitly declare their sentiments. There is a mysticism in their expressions and manner, calculated to delude the ignorant, and perplex those who have not fully considered the subjects under discussion. Therefore, it seemed right to place distinctly before you, in the first lectures of this year, the only opinions which the mind of man is capable of entertaining, relative to the causes of motion in matter. In exploring the cause of the contrary states of motion and rest, the mind's eye alternately dimmed and dazzled, becomes weary and confused, and ceasing from the fruitless search, fixes itself upon a partial view of the subject, which it thinks it has obtained. We feel a strong conviction, that a more subtile and mobile substance, or a more attenuated species of matter pervades, acts

upon, and is the cause of motion in that which is more gross and inert.

Who can observe the seemingly vital effects which the warmth of the sun produces, even in common matter, or the terrific and destructive consequences of intense heat, without thinking that heat must be essentially active, or that it excites actions in something that is so.

Who also can observe the quick and powerful motions of animals, without believing that something active is incorporated with them? The consideration of the vital phænomena call upon us to admit, that there is some power of controlling, exciting, and modifying those chemical changes, to which the atoms composing them have, under certain circumstances, a propensity, as well as of arranging the materials in diversified structures. Philosophy must always be founded in Nature, and its rules be adapted to the subjects to which they belong. It is natural to man to observe, to enquire, to reason, to believe in various degrees up to perfect conviction; and we may perform any of these acts, according to the precepts of philosophy. Scepticism has no right to boast of an exclusive claim to be accounted philosophical. Confidence may also be as philosophical as doubt. It is absurd to expect mathematical demonstration in subjects which do not admit of it, and the absurdities of determined doubters have been exposed by writers both of a serious and satirical cast.

Now, though the changes occurring in common matter are extremely diversified, and highly contributory to all the wants of living creatures, they are still so uniform as to afford a plea for maintaining, that they may be the effect of inherent propensities in the atoms of which this matter is composed. But to suppose that all the varieties of vital action and other facts belonging to the structure and economy of living beings, which we have been lately considering, are the results of inherent propensities in the atoms of matter, unassigned and unsupported by intelligence, seems to me too absurd to require any attempt at serious or formal refutation. I have therefore, never, except in one instance, paused to make those reflections which the subject so constantly and naturally excite, and now, in conclusion, I will only observe, that upon the supposition just mentioned, we must be led to expect the phænomena to be more uniform or more diversified; nor could we imagine it possible, that there should be that regularity in their series, and that adaptation of means to ends, which we so constantly observe.

It has been said that "an undevout astronomer is mad;" yet he only contemplates the immensity and order of the works of Nature, and the causes of the varieties of light and seasons, so serviceable to the living beings which inhabit this planet, and, as he infers, to those of others. But what shall we say of the anatomist who observes the structure and functions of those beings, who examines their extreme variety, and regular gradation and connection, without any feeling or perception that Intelligence has operated in ordaining the laws of nature? We judge of others by ourselves, and assuredly such a character must, by the bulk of mankind, be considered as possessing either a deficient or perverse intellect.

The opinion that Intelligence must have ordained the order of Nature, is not only impressed by her decrees upon the bulk of mankind, but is confirmed by the observations and reflections of the most observant and intellectual individuals of the human race. Those who think that intelligence may exist distinct from organization, are disposed to admit that the intelligence with which they are endowed, may have a separate existence. Those who think that perception is not essential to life, but is an attribute of something different, are also disposed to admit the separate existence of perception and intelligence; and thus do these two opinions produce and support each other. Both opinions are natural to most men, and confirmed by the observations and consideration of the most intellectual of the human race.

Gentlemen, I was presumptuous enough in the first lecture to imagine myself that honourable character,—a British advocate. I also imagined that you were impannelled as a jury, a tribunal in which we glory, and by whose decision we must abide. Now, however inadequate I may be to perform the part I have arrogated to myself, you are fully competent to discharge the duties of the tribunal I have supposed you to form. You have the ability to decide, and the power to punish. You can inflict the severest of all punishments, that of which the greatest despots stand in awe, those who may be said to be "safe from the bar, the pulpit, and the throne," yet tremble at the strong and open expression of general disapprobation. The medical republic should legislate for itself, for the public in general know little of our peculiar studies, and may consequently estimate our opinions with respect to

certain subjects at a much higher value than really belongs to them. We should not therefore suffer crude speculations to go forth, bearing the seeming stamp of medical authority, when they are contrary to the sentiments of the bulk of the profession, derogatory to its character, and injurious to society.

In arguing the subject relative to the opinions which we are warranted to form respecting the nature of life, I disclaim having any allusion, in what I have said, to those of particular persons; and I have, as much as possible, endeavoured to conceal all perception of individuals, by massing them together in a crowd. I contend with no man about his opinions; for charity instructs me to believe that each forms the most correct opinions he is capable of doing. I contend only against the promulgation of those that have a pernicious tendency. In the assumed character of a British advocate, I must be an advocate for liberty; but then, it is for British liberty, for rational liberty, for liberty without licentiousness, for the liberty that our laws allow, which confirm to every individual his natural rights, giving him licence to think and act as he pleases, or deems proper, so long as his actions do not tend to the detriment of other individuals, or to that of society in general. Let me not either derogate from my assumed character by neglecting to remind you, Gentlemen, that the consideration of the *quo animo* is the vital principal of the British law. There may be inconsiderate persons who commit error without adverting to its diffusively baneful consequences; who, thoughtless of the course and contingencies of human life, may undesigningly broach opinions tending to weaken and destroy others which form the spring of every generous and noble action, and our only support under oppression and affliction. There may be those who do not perceive how our notions respecting life can influence our conduct. But this indeed surprizes me, because Voltaire was so well acquainted with the evil tendency of his own doctrines, that he checked the conversation of his companions, whilst the servants remained in the room, lest, observed he, we should have our throats cut.

That ignorance may not, however, be hereafter pleaded in mitigation of your verdict, I deem it my duty, with the utmost brevity, to represent the effects of different opinions upon human actions. For this purpose, I first select the case of a powerful monarch, called by historians Sardanapalus; who chose, for reasons perhaps best known to himself, to write his own epitaph, as follows. "Eat, drink, and be

merry; for the rest is nothing;" an epitaph, says Aristotle, fit for a hog. It cannot be doubted, that Sardanapalus was one of those who considered the grave to be a "place of eternal rest." To show the effects of the contrary sentiments, I would ask, is it credible that Socrates, after drinking the poison, would have calmly discoursed on philosophical subjects with his friends; or that Brutus would have stabbed the Roman he most loved, rather than suffer his country to be enslaved, had they not formed a proper estimate of human life, and considered themselves but as performing a part, in the presence of immortal and intelligent observers? Or why does the untutored Indian deride the cruel torments of his enemies, but that he also believes he is going to the land where his father is gone, and would feel shame to be recognized a degenerate son?

Being desirous to avoid all personality, and to contend only against opinions, it seemed necessary to denounce those that I meant to oppose, at the very outset, and in the first lecture; for if we try to hit a mark, and others are to judge of our success or failure, it is necessary to place the object distinctly in the view of the observers. Yet even in ascribing opinions and conduct to a party, under the denomination of modern sceptics, I may give offence; for some may suppose themselves comprehended in it, though they do not actually belong to it; whilst others may even think it unwarrantable to suppose that there can be any such party as I have described. Hesitation in decision is natural to many characters, and caution, to a certain extent, is an indispensable ingredient in all those who have any pretensions to be accounted philosophers. But the party I allude to are not real sceptics, and their professions and conduct form a curious example of a *vis inertiæ;* for after resolving not to think on certain subjects, they argumentatively endeavour to prevent others from thinking; whilst on the one side they reject a very few propositions, merely because they are deficient in a kind of proof that the subject does not allow of, and that cannot be rationally required; on the other, they admit a host of absurdities, apparently without examination. Therefore, upon the very grounds of their own doubt, they marshall and exercise pernicious and discordant opinions, drawn from every possible and remote source, with which they assail the opinions of others, that at least may be said to be innocent and useful, but which also confer a dignity on human nature, and excite us to generous and honourable actions. I feel it

to be my duty, Gentlemen, to prevent, if possible, the banners of physiology from being purloined and carried into such a service; and yours not to suffer those of our profession in general, to appear in so disgraceful and mischievous a contest.

There are "Smellfunguses" and "Mundunguses"* in science. I pity the man who can survey all the wonders of the vegetable and animal kingdoms, who can journey through so delightful a district, and afterwards exclaim, "all is barren." Still more do I pity those, though the sentiment is mixed with strong disapprobation of their conduct, who, after having seen much to admire, shall, when they meet with a circumstance they do not understand, presumptuously dare to arraign the wisdom and benevolence of Nature. In the progress of science, many things which at one time appeared absurd and productive of evil, have afterwards, upon an accession of knowledge, been found to be most wise and beneficent. I deem no apology requisite Gentlemen, for endeavouring to impress on your minds certain axioms relating to philosophy in general, when they are directly deducible from the subjects of our peculiar studies. I have constantly and carefully avoided every argument foreign to the subject, so that, if occasionally I may have appeared to sermonize, I have quoted both the chapter and verse of my text from the Book of Nature, I address you, Gentlemen, as students of that great book, and earnestly exhort you to study it with such sentiments as I have endeavoured to inculcate. The conviction that every thing tends to some immediate or eventual good, is the greatest incentive to its study. It was this conviction that excited Hunter to such continual enquiry, or involved him occasionally in the depths and perplexities of intense thought; for he was never satisfied without being able to assign an adequate reason for whatever he observed in the structure and economy of animals. This conviction makes the study of Nature highly interesting, and may indeed be said to render labour delightful, or to medicate the pains attendant on its toil. To those who entertain such sentiments as I have endeavoured to inculcate, every thing seems animated, beneficent, and useful; they have the happy talent of discovering even

> "Tongues in the trees, books in the running brooks,
> Sermons in stones, and good in every thing."

* Characters thus denominated, and pourtrayed by Sterne in his Sentimental Journey.

APPENDIX.

Extract from the European Magazine for 1782, containing a Syllabus of a course of Lectures on the principles of surgery, delivered by Mr. John Hunter, F.R.S., St. James's, London; with Anecdotes of his Life.

THIS very celebrated Course consists of near an hundred Lectures.—It begins in the month of October, and continues till April, and is given every other evening, from seven to eight o'clock, the honorarium being four guineas.

Mr. Hunter's Lectures do not contain a Course of Practical Surgery, with the Operations necessary for different cases—but his purpose is to give a comprehensive view of the system, and investigate the principles upon which the practice of surgery is founded, viz.—To show the actions of the body and its parts when in the diseased state, with the actions and effects of nature to recovery—and the necessary and proper assistance to be given by the Surgeon. The principles of diseases are the first parts of surgery to be learned. They are to the Surgeon what the first principles of the mathematics are to the practical geometrician, without the knowledge of which a man can neither be a philosopher nor a Surgeon. In our research after diseases, says Mr. Hunter, we ought not only to understand the case, which becomes the immediate object of Surgery, such as inflammation, suppuration, mortification, &c. but also the cause of the effect; for without this knowledge our practice must be very confined, very precarious, and often applied too late. This knowledge opens to the Surgeon varieties of treatment. It teaches him in one instance to remove the cause—in another to increase the effect—in another to change it to some other disease—and gives him, what is the most essential point, the knowledge of the proper moment for the surgical operation, where an operation is necessary. In the animal body the power of restoration to a state of health arises out of the Animal from

its own mechanism and action. If the animal was in all cases equal to the task, there would be no occasion for the Surgeon; but it is necessary in many cases to assist nature by the introduction of artificial powers—to increase the living powers of the Animal when they are inadequate—to retard them when violent—or to change them when wrong. Both the chemical and mechanical powers are made use of in Surgery.—Chemistry is introduced to destroy what cannot be altered—and mechanics frequently restore what had been accidentally or artificially destroyed. It is not only necessary for a Surgeon that he should know the different parts of an animal, but he should know their uses in the machine, and in what manner they act to produce their effect. He ought not only to know the whole of any one simple action, or the knowledge of all the actions singly—but he should ascertain their correspondence—mark their relations, and acquire a competent idea of the compound actions and general fabric of the machine. Operations should never be introduced but in cases of absolute necessity. A Surgeon should never approach a victim for an operation but with humiliation—it is a reflection upon the healing art. He is then like the Savage in arms, who performs by violence what a civilized nation would accomplish by stratagem.

Mr. Hunter having observed, that the greatest part of the books published in Surgery, contain little else than relations of cases, and modes of treatment, and that the practitioners have been too easily satisfied with a collection of facts, without embracing the catalogue of diseases as a system, proposes in his course to examine the theory and principles of diseases in a regular series. His doctrines are drawn from personal observations made in the course of an indefatigable life, with the constancy of a most adventurous mind. His ideas, his mode of reasoning, as well as his arrangement of diseases are new; and he therefore has received little aid from books or from other professors. The novelty of his ideas occasion also the application of new terms; and those which he has given, he may consider as clear and explanatory, since they are adopted by others, and brought into use.

The Course begins with the Physiology, or natural History of the Animal; but so far only as is necessary to the understanding the principles of diseases; in which new ideas and new arrangements of the subject are introduced.

The Physiology of Diseases follows—the action of medicines—and brings him to the consideration of diseases in general.

The Diseases of accident being the most obvious and simple, in preventing the natural operations of the Animal. begin the Surgical part of the Lectures, in which he explains the most simple modes of restoration.

Then follow the diseases whose mode of action is similar to those arising from accident.

As the treatment of diseases arising from accident is various, those which are the most simple come first in view. This leads him therefore to explain,

The first mode of union of separated parts, called "Union by the first intention," and

Inflammation.

On both these subjects he is very full, especially the latter, as it is one of the first principles in most diseases, and produces a variety of effects.

Inflammation leads him to the second mode of the Union of parts; as happens in wounds where the first mode has failed, or has been neglected. This also leads him to

The Union of Parts originally in contact only as the natural cavities, but united for very wise purposes, and which are called Adhesions.

The cure of many diseased parts, as fistulas, indurated tumors, &c.

The diseases of bones.

The knowledge and cure of gun-shot wounds.

Inflammation also makes a principal part in all specific diseases, as the Small-pox, Lues Venerea, Cancer, &c.—and therefore he takes great pains to investigate its principles.

Then follows Suppuration, and those actions are illustrated by the consideration of

Compound Fractures, Hydrocele, Suppuration of the veins after bleeding; gun-shot wounds, &c.

And, in the second place, by the various diseases arising from spontaneous suppuration, as abscesses, diseases of the bones, diseases of the joints, &c.—This leads him to the consideration of

Granulations, their course, progress, kinds and use; and also of

Cicatrization.

After Inflammation and its general consequences, he proceeds to treat of specific diseases, such as

The Lock Jaw.

Scrophula.

Poisons in general.

Peculiar Poisons, as the Lues Venerea, Cancer, &c. &c.

This Course of Lectures is illustrated by a collection of diseases, and of Comparative Anatomy, which, in point of curiosity, accuracy, and comprehension, is equal to any collection in the world. It has been made by Mr. Hunter himself, and what chiefly contributes to its extraordinary value and advantage is, that he knows the particular history of the greater part of the diseases, which he has preserved—the patients were under his observation in the Hospitals—he has minuted the progress, and accounted for the various appearances and effects of each disease, with a fidelity that now renders his collection a most instructive school for the Student.

ANECDOTES OF MR. JOHN HUNTER.

We have introduced the Syllabus of the Course of Mr. Hunter's Lectures on Surgery in this place by choice, as he is the brother of the celebrated anatomist, Dr. Hunter, whose Lectures made the subject of our first number. When so eminent an example occurs of congenial talents and contemporary distinction in two brothers, it would be an outrage to separate them. We might have been permitted to deviate from regular order for the sake of so extraordinary and so splendid a circumstance; but when no method nor link is broken, it would have been unpardonable to have overlooked the opportunity of gratifying the honourable pride of man in the exhibition. Dr. Hunter having settled in London, sent for his brother John, who accordingly came to England, being at that time in his eighteenth year. He immediately applied himself to the study of anatomy and surgery; and, for several years, he was employed in the dissecting-room, where he suddenly began to display his uncommon abilities. The doctor was anxious that he should go into partnership with him, and in the year 1758, declared him to be fully adequate to the important office of a Teacher; but Mr. Hunter, with a modesty which is always the attendant of genius, felt insuperable embarrassments and objections to speaking in public, and he declined the advantageous and honourable offer, on account of his aversion to public speaking, and his extreme diffidence of his own abilities and skill. But he continued in the same anatomical pursuits till the year 1760;

when, anxious for a more enlarged field of observation, he went out as Surgeon General to the Army, first to Belleisle, and afterwards to Portugal. In this extensive scene, he indefatigably studied the nature and treatment of gun-shot wounds; and he acquired great credit from his humanity and talents. He has constantly, in his practice, been an enemy to operations—he has resorted to them unwillingly, in the last resource, although no practitioner has been more distinguished for a steady and skilful hand in an operation than himself, where necessity drew him to the expedient.—On the peace in 1763, he returned and settled in London as a surgeon, and came, in a very short time, to the possession of an extensive practice. Now it was that he began to form his system. In books he found, as we have mentioned, no other lights in the investigation of surgery, than what arose from the enumeration of independent facts and cases, without reasoning and without principles. He totally rejected books, and took up the volume of the animal body.—He was as indefatigable in his pursuits, as he was adventurous in his conduct. Though an enemy to operations on others, he was regardless of himself, and exposed his person to all the active and artificial powers, by which he might ascertain the properties, and trace the effects of medicine on the human frame. He was not deterred by the shocks which such trials must necessarily give to his constitution; nor by the fatigue, labour, and loss to which they exposed him. He began at the same time to form his collection of diseases; and for this purpose he attended the various hospitals, in order to see the curious cases, and to observe, with his own eyes, the progress of the various diseases, which he might procure into his custody. He from this time also employed himself in forming his collection of comparative anatomy. The whole together has cost him more than 10,000*l.* besides the labour it has required in the preparations. Of this sum more than two thousand pounds have been expended in the purchase of dead animals only. In the year 1768, he was chosen Surgeon to St. George's Hospital; and in the years 1772, 1773, and 1774, having collected his ideas and observations, he assembled the pupils of that Hospital, together with a few chosen friends, and read to them, without expense, a course of lectures on the principles of surgery. In the year 1776, he was appointed Surgeon Extraordinary to His Majesty. Prior to his going abroad, he had been present at the dissection of more than two thousand human bodies, and in the year 1754 or 55, dis-

covered the structure of the placenta, and the communication between the mother and placenta. He had also employed himself a good deal, even at this time, in comparative anatomy, and had discovered the absorbing system in fowls, and in the crocodile, which is one of the amphibii, proving by experiments that the red veins did not absorb. This was published by Dr. Hunter, in his Commentaries, in 1762. Since his return, as we have already mentioned, he has been particularly earnest in his attention to comparative anatomy. He has a house and gardens in the country, on purpose for his experiments on living animals and vegetables. For the last five years he has employed in his house an ingenious draughtsman, who is engaged, at a regular salary, for ten years; and also another person, engaged for the same time, to manage and keep his preparations in order. He means to class the animal world according to their structure, in which he has made considerable advances. His objection to standing forth as a public teacher still continued—and it was only overcome by the intercessions of his friends, and by his own consciousness that he might be useful to students, in explaining the principles and analogies which he had observed in diseases, and reducing thereby the art to a more regular and less precarious system. Dr. Hunter's library is, perhaps, the finest in Europe in choice, scarce, and valuable copies, and it cost 16,000*l*. Mr. Hunter's is comprehended in a few cases, and were it not, he says himself, for the presents made him by contemporary authors, would hardly have consisted of a hundred volumes. His opinions, therefore, are all his own, drawn from personal observation;—he does not say that every doctrine is new—some of his opinions may have been given before—but they are new to him. He acts in his character of a public lecturer, with the disinterestedness that has marked his conduct through life; for though the honorarium is only four guineas, the course continues six months; whereas there are courses of lectures, comprehending both anatomy and surgery, which are gone through in the short space of six weeks. We by no means think ourselves qualified to pronounce on the merits of living teachers. It is our business to state the simple facts, and to be cautious that, in our collection of the materials, we are neither imposed on ourselves, nor impose on our readers.

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